

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

DIESEL PROGRESS



JUNE, 1936

CIRCULATION OF THIS ISSUE—IN EXCESS OF 10,500 COPIES

25c

Behind the Quality of GULF DIESEL LUBRICANTS

*is the world's most
modern petroleum
research laboratory*

WHAT is the rate of oxidation of an oil? What chemical changes take place in an oil after certain periods of severe service? What is the best oil for a particular type of bearing?

Gulf scientists are finding the answers to these and thousands of other questions regarding lubricants in Gulf's modern research laboratory shown below. Many types of experimental machines duplicate the conditions under which oils perform in actual service.

Thus, the knowledge gained by many years of practical experience in thousands of industrial plants throughout 28 states in lubricating machinery of every type can be supplemented with newly discovered facts. And the user of Gulf Diesel lubricants is assured that *when science develops improved petroleum products they will be available to him.*

(Above) A new machine developed by Gulf engineers—the first that will test any type of bearing under precisely the operating conditions of actual service. It measures accurately friction, torque, temperature, wear and film thickness. In this way Gulf is able to recommend and supply the most desirable lubricant for any bearing.

(Right) This complicated apparatus is used to study the behavior of oils at high temperatures in the presence of oxygen. Oils deteriorate rapidly under these conditions, forming organic acids, insoluble sludges and soluble impurities of high viscosity. Samples of the oil are withdrawn at frequent intervals for test, and the changes measured. Gulf Diesel oils have highest resistance to such deterioration.

(Below) A night view of the new laboratory of the Gulf Research & Development Corporation near Pittsburgh, Pa. In this laboratory are many machines and apparatus of various types which test lubricants under operating conditions similar to those encountered in actual service.

GULF

INDUSTRIAL
LUBRICATION

GULF OIL CORPORATION OF PENNSYLVANIA

GULF REFINING COMPANY

General Offices: Gulf Bldg., Pittsburgh, Pa.

HARNISCHFEGER picks a TOUGH HOMBRE

Webster says:

"tough"—able to endure strain, hardship, or severe labor; having or manifesting great physical resistance; hardy; robust."

. . . to power its

765

They wanted brute strength in the new Harnischfeger "765" 2-yard Pacemaker. They wanted an Industrial Diesel with power . . . to handle swing, crowd, and hoist. The economy that would keep costs down.

For years, F-M Diesels have given them this performance. Compact, completely self-contained, they permit shovel operators to keep on the job without having to watch the power plant. And every

test proved them as "tough" as Mr. Webster could have desired in his famous definition.

Every manufacturer and user of shovels, clam shells, draglines, cranes, and allied equipment should get the full story of the complete Fairbanks-Morse "36" line and what it can do. For full information, address Department I-81, Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

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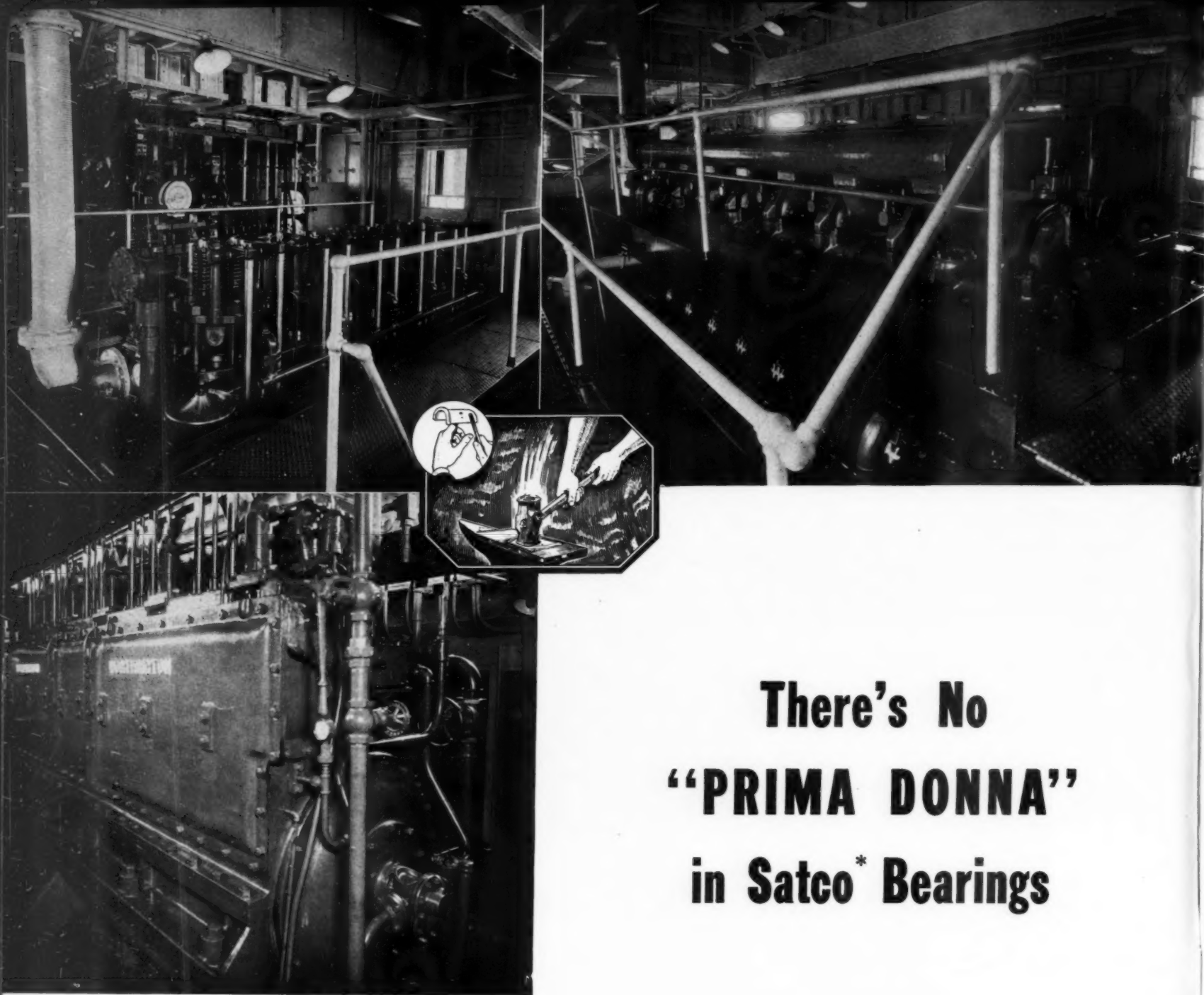
YEARS OF
PRECISION
MANUFACTURING

FAIRBANKS - MORSE

Diesel Engines



POWER, PUMPING AND WEIGHING EQUIPMENT



There's No "PRIMA DONNA" in Satco* Bearings

SATCO-LINED bearings have never sought the easy jobs in industry . . . and have never side-stepped the tough ones. If there were any "quit," any temperament, in Satco it would have showed up long ago. In the Diesel field, in particular, it has been our job to design and fabricate Satco bearings for many kinds of power application — from small, fast, light-weight engines to big, heavy power plants like the one pictured here. Satco linings have stayed on the job long after the "prima donnas" have called it a day.

Worthington Pump & Machinery Corporation wished to avoid the risk of premature bearing failure when they built the above engine for the McWilliams dredge "Natchez", so Satco-lined bearings were installed. This Diesel, Worthington's largest, is an 8-cylinder, 4-cycle engine, 16" x 20", delivering 1000 horsepower at 327 rpm. It is operating at Breaux Bridge, Louisiana.

If you are building or operating Diesels, let us furnish some eye-opening facts about Satco-lined bearings.

*A patented alloy manufactured by National Lead Co. Trade mark registered.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

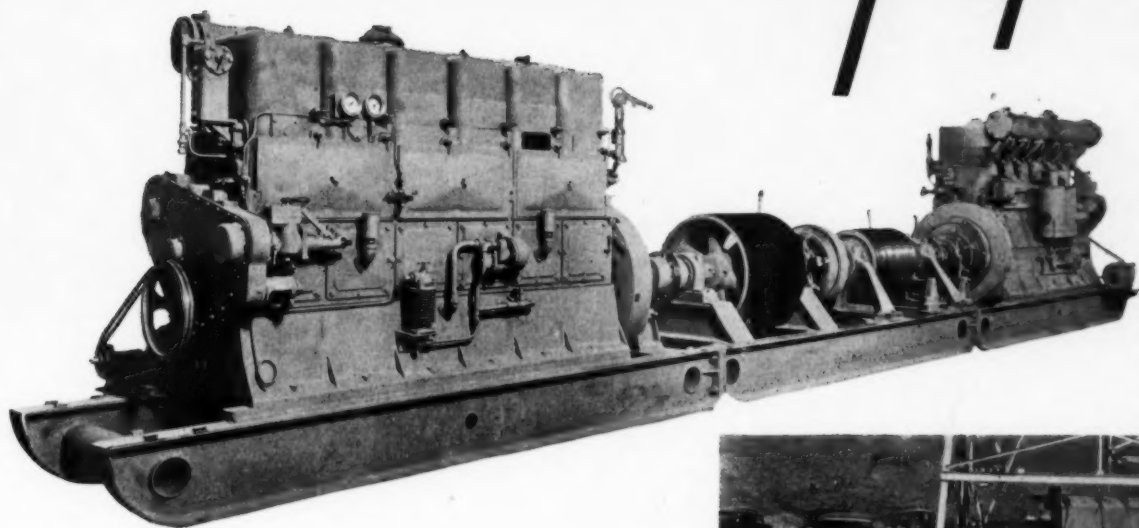
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INDIANA

ATLAS-RICHARDS

Diesel-Electric Drilling Rigs Provide:



SIMPLICITY

Complete control from the drillers station.

MAXIMUM ECONOMY

Provides power at about a tenth the cost of steam, a sixth the cost of gasoline, and often lower than the cost of high pressure gas.

DUAL POWER

Two systems of transmission, taking advantage of the unexcelled flexibility of the speed and torque control inherent in a variable voltage direct current drive for operating the drawworks, and the high efficiency of the direct belted drive for operating the pumps.

EMERGENCY STANDBY POWER

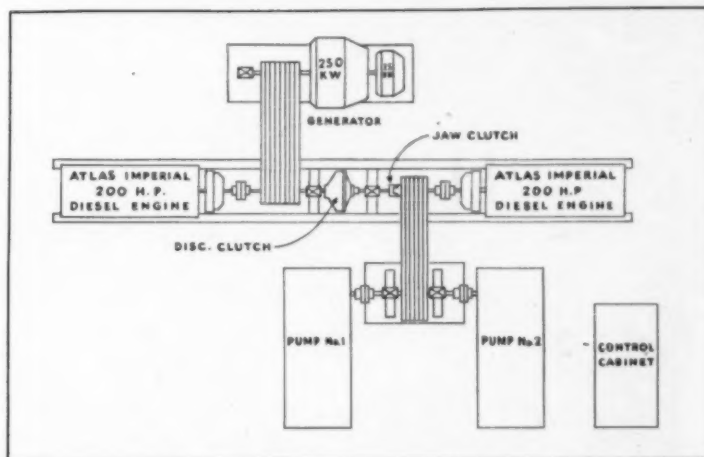
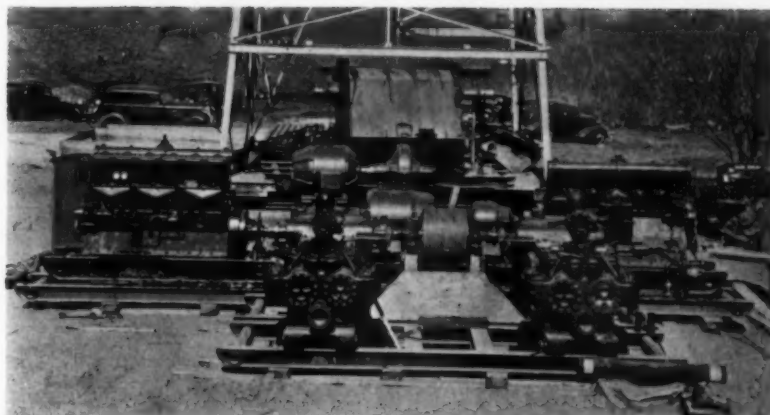
The hookup is so designed that if either engine is incapacitated the other engine will provide sufficient power to bring the string of tools out of the hole.

INDEPENDENT SPEED CONTROL

The arrangement permits the speed of the hoisting motor to be independent of the pump speed. The driller can disconnect the compounding clutch and operate the mud pump at a speed independent of the rotary table.

SAFETY OF EQUIPMENT

The differential field winding of the generator makes it impossible to impose a dangerous overload on either generator or Diesel engine.



The Atlas-Richards hook-up illustrated above is one of several that are depicted in our new Drilling Diesel Bulletin. May we send you a copy of this new booklet.

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIFORNIA • MATTOON, ILLINOIS

ATLAS IMPERIAL

Joe E. Brown as Alexander Botts, the famous tractor salesman, and his victim Guy Kibbee, in the forthcoming Warner Bros. comedy "Earthworm Tractors"



DONALDSON OIL-WASHED-AIR CLEANERS

Notice the two Donaldson Oil-Washed-Air Cleaners that keep the "Cat" purring contentedly. Write us for complete information.

DONALDSON COMPANY, INC. • 666 Pelham Street • St. Paul, Minnesota



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The repeated use of ERIE crankshafts by all leading engine builders proves their superior quality and accurate finish.

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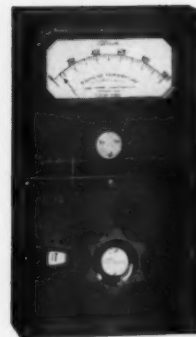
**ERIE
PENNSYLVANIA**

PIERRE SOUTH DAKOTA

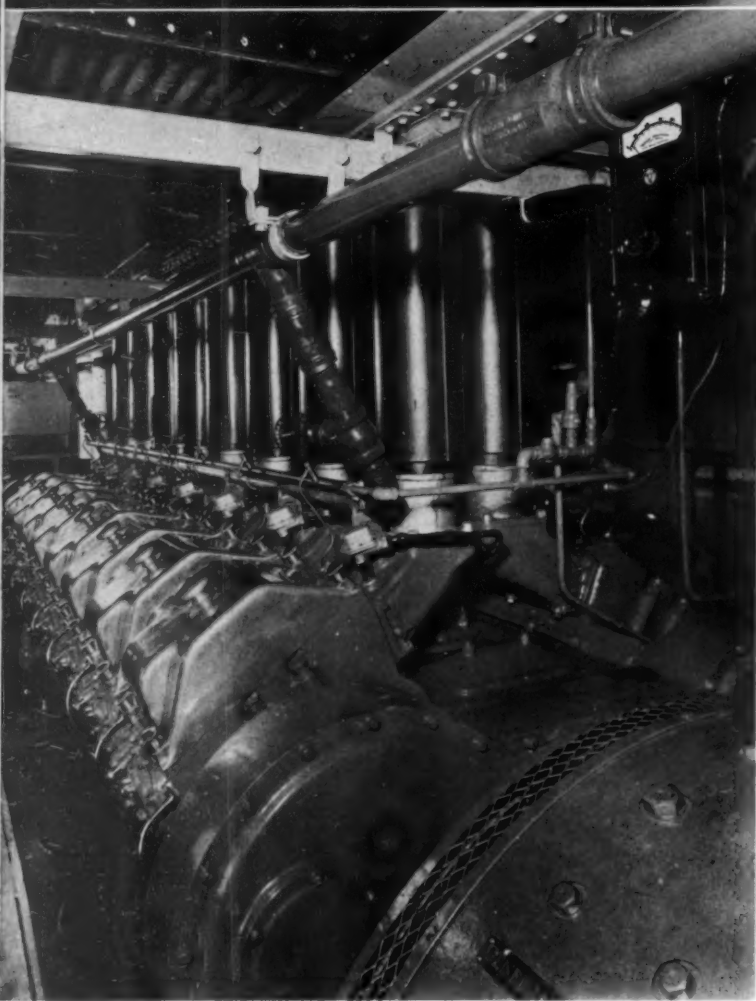
An ERIE crankshaft selected by Worthington Pump & Machinery Corp. for the eight cylinder, 17" x 25", 4 cycle, 1000 horsepower engine installed in the Pierre, South Dakota, municipal plant.

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.





Type 2804 "Alnor"
Pyrometer.



The GREEN DIAMOND

Protected with "Alnor" Pyrometers

THE Diesel engine in the *Green Diamond*, the new streamline train of the Illinois Central built by Electromotive Corporation and powered by Winton engines are protected by a permanently mounted "Alnor" Exhaust Pyrometer.

The view above of the engine room clearly shows the "Alnor" Type 2804 pyrometer together with the thermo-couples of one side of the V-Type Winton engine.

"Alnor" pyrometers for locomotive, shovel and excavator service are equipped with movements especially designed to withstand the vibration, shocks and jars encountered.

Numerous types and sizes of "Alnor" pyrometers are offered for single cylinder to a combination of cylinders of 24 or more.

Write for full information.

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"Alnor" Pyrometers—The Engine X-Ray

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Many years of ceaseless effort have been required to perfect the Hemphill System of Diesel Training . . . to obtain the world's largest assemblage of Diesel engines for training purposes, which includes slow, medium and high speed engines of many types . . . and to select a corps of thoroughly competent engineering instructors. The thoroughness of Hemphill Diesel Training is best evidenced by the large number of Hemphill graduates who are holding positions of responsibility with both manufacturers and users of Diesel engines.

Three practical Diesel Courses are offered by the Hemphill Diesel Schools: a Day Course, a Night Course, and a combination Extension Course with later shop practice.



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THIS ENGINE SUPPLIES CURRENT FOR
THE SCHOOL AT A FUEL COST OF 8¢ PER H.P.

THIS ENGINE IS
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ALNOR PYROMETER

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Please send me free copy of "Diesel News" containing interesting facts and latest news about the use of
Diesels, and Proof that Hemphill Training Pays

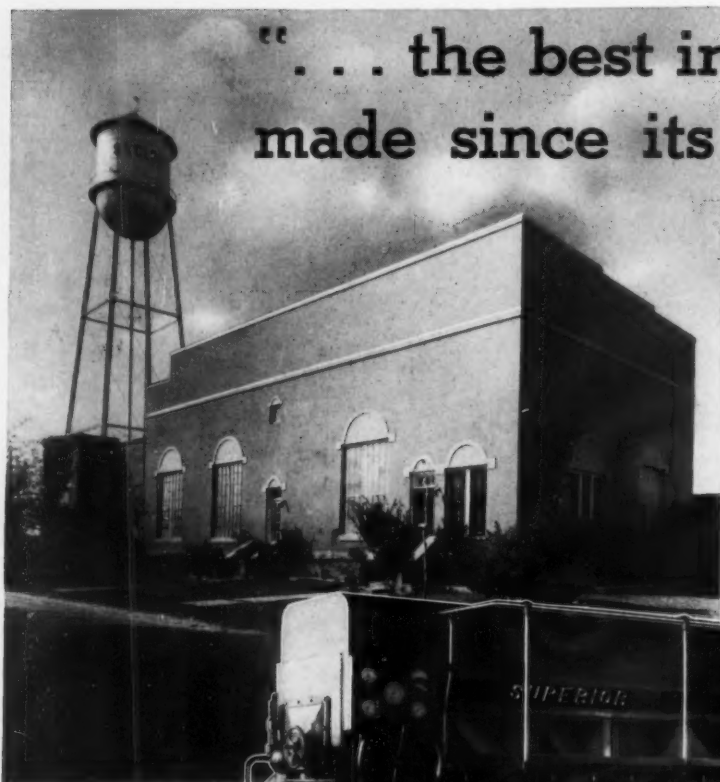
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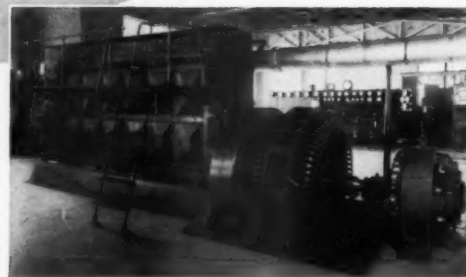
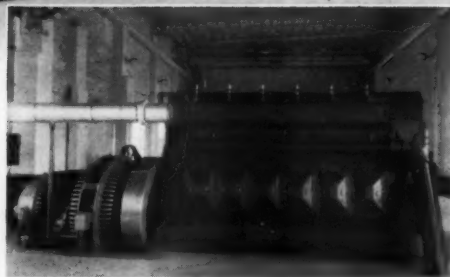
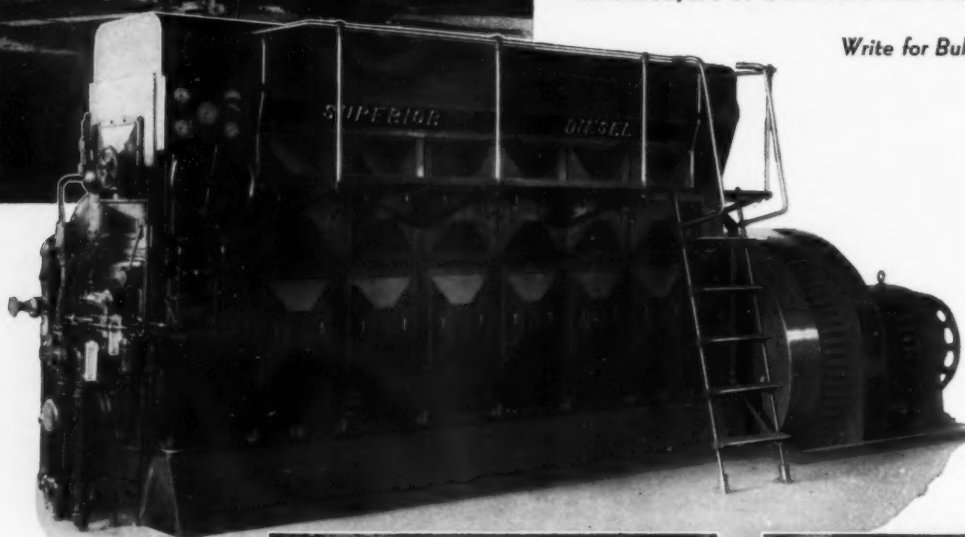
"... the best investment the City has made since its Charter was granted"

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UTILITY COMMISSIONER,
CITY OF ST. CLOUD, FLA.

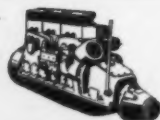
Superior Diesels afford the same opportunity to Industrial Power Users . . . to transform expensive power into profitable power at a nominal cost.

These economies are available to the small or large power consumer . . . Superior Diesels range in sizes, 25 to 900 H. P. in 3 to 8 cylinder models.

Write for Bulletin DRJ-133



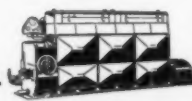
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25 to 150 H. P.

THE
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COMPANY
SPRINGFIELD, O. . . . LOS ANGELES, CAL.

50 to 900 H. P.



THE OTTO ENGINE WORKS

PHILADELPHIA, PA.



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The whole Red River operation is typical of the bigness of the western woods.

And right at home in this setting are the great Allis Chalmers Tractors with their own L. O. system of oil burning power, individually designed by A. C. Engineers for the Allis Chalmers line.

And, as is usually the case when special

problems are met, Purolator Oil Filters are one phase of the answer.

Purolator Engineers have kept thoroughly abreast of all phases of Diesel progress, and solicit your inquiries on any question that might arise concerning either fuel or lube oil filtration. Motor Improvements, Inc., Newark, New Jersey, makers of

PUROLATOR

The Oil Filter

Specify
**COMPLETE ELECTRICAL
 EQUIPMENT** *from one
 dependable source*



WESTINGHOUSE GENERATORS DRIVEN BY NORDBERG DIESELS—At this Diesel-electric power plant in Carthage, Missouri, three Westinghouse generators (two rated at 1100 kv-a. and one at 625 kv-a.) are driven by Nordberg Diesel engines.

IN Diesel plants of every type and purpose . . . teamed up with engines of every make . . . you will find users who know it pays to specify complete electrification by Westinghouse.

Westinghouse has kept pace with recent improvements by Diesel engine manufacturers, and has perfected engine-driven generators *plus* all of the auxiliary electrical apparatus needed to complete your Diesel power

plant installation . . . including such equipment as exciters, motors, switching accessories, etc. Every separate piece of Westinghouse equipment is built with a thorough knowledge of its function in relation to the complete installation . . . measures up to a single standard of quality . . . is backed by 50 years of electrical experience . . . by a manufacturer willing and able to assume full responsibility.

J 10009

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 showing the scope of
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Everything
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Centralize responsibility for your electrical installation in one reliable source and secure the advantages of 50 years' electrical experience by Westinghouse.



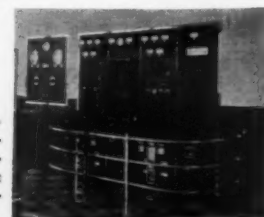
EXCITERS—Either direct-connected or belt-driven, as required.

ES GENERATORS—Especially designed for lifetime operation in Diesel service, with these extra values: Solid Steel Rotor, to withstand severest stresses under all conditions. Protection against Shut-downs, insured by exclusive high frequency pre-testing. Positive Ventilation, for cool running and long life.



MOTORS—With dual-protected windings, rigid cast frames, and sealed-sleeve bearings . . . for driving compressors and other auxiliaries.

COMPLETE SWITCH-BOARD ACCESSORIES—For every requirement: instruments, instrument transformers, relays, switch-gear, circuit breakers.



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**How to keep rings free...
hold compression...
save on fuel...**



Photo courtesy of Hemphill Diesel Schools, Inc.

When carbon is light enough to blow out of the exhaust...

When there are no deposits formed to stick your rings...

When an oil is pure enough and tough enough to continue to withstand the high pressures and temperatures of your combustion chambers...

Cylinder liners stay on the job, bright, smooth, and serviceable year after year.

You will get such performance with Texaco Algol and Ursa Oils because they are made from *special crudes* and espe-

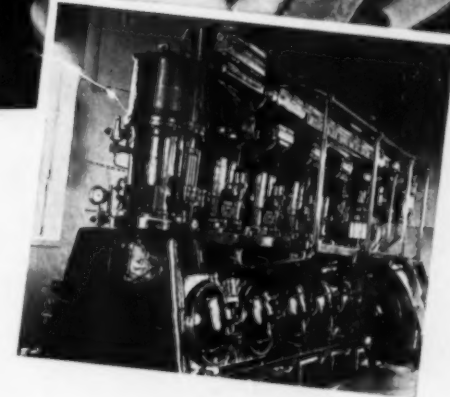
cially refined to remove the last traces of harmful carbon forming elements.

More than that, because of these qualities, you will get complete piston seal, eliminate blow-by, reduce crankcase dilution, get maximum compression, complete combustion, and...

Absolute fuel economy.

This is why, today, *more Diesel horsepower in the U. S. is lubricated with Texaco Algol and Ursa Oils than with any other brand.*

A Texaco representative will be glad



to provide practical engineering service to prove to you the economies of Texaco Products.

THE TEXAS COMPANY
135 East 42nd Street New York City
Nation-wide distribution facilities assure prompt delivery



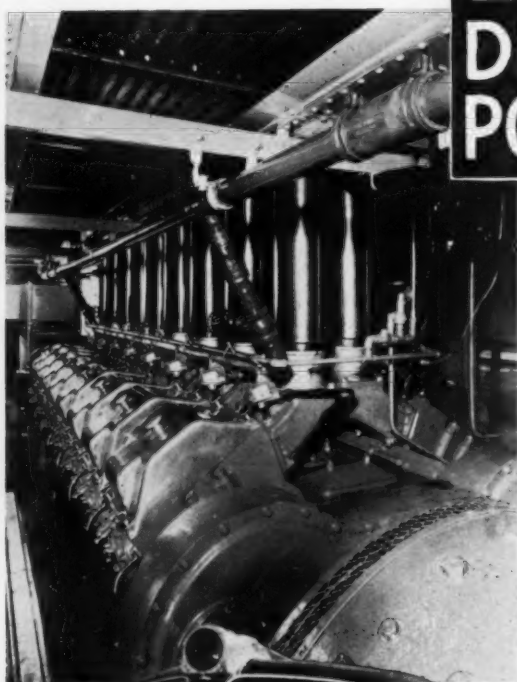
TEXACO LUBRICANTS

for all types of Diesels

AGAIN . . .

What makes them Go —

**EMC
DIESEL
POWER**

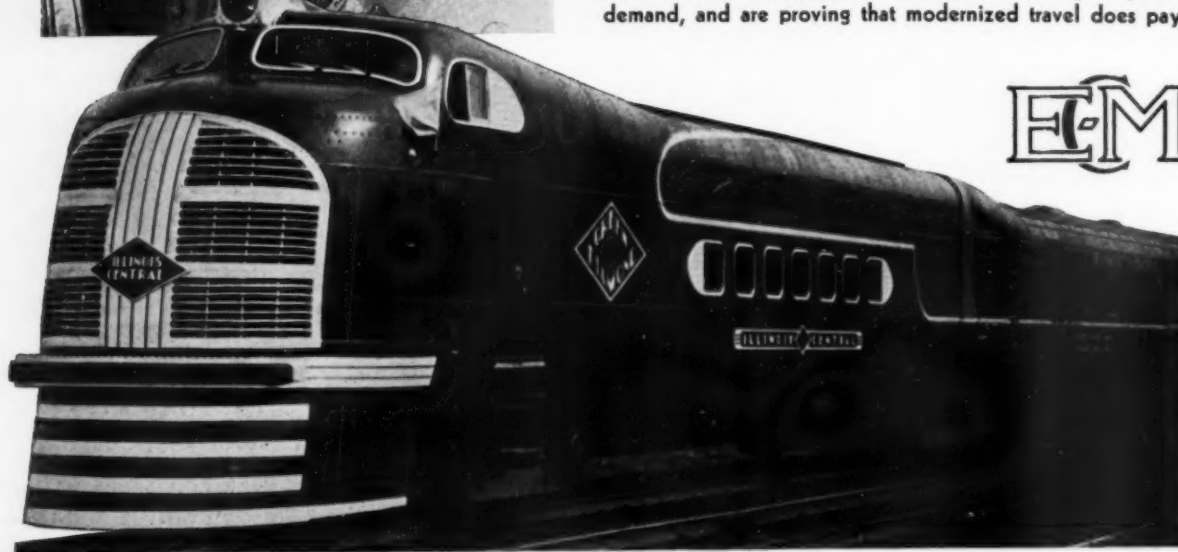


ILLINOIS CENTRAL'S new 5-car streamliner "GREEN DIAMOND" — powered with EMC 1200 H.P. Diesel engine — the latest contribution to the fast-growing list of modern, high-speed, super-luxurious trains which are making railroad history today.

Similar EMC Diesel-powered streamlined units on the Burlington — Union Pacific — Boston and Maine — are piling up records for dependability, low operating costs and increased passenger revenues.

The "GREEN DIAMOND" is certain to be an outstanding success.

No longer experimental — with established records behind them — EMC Diesel-powered trains are answering the public demand, and are proving that modernized travel does pay.



ELECTRO-MOTIVE CORPORATION
LA GRANGE, ILLINOIS, U. S. A.

DIESEL PROGRESS

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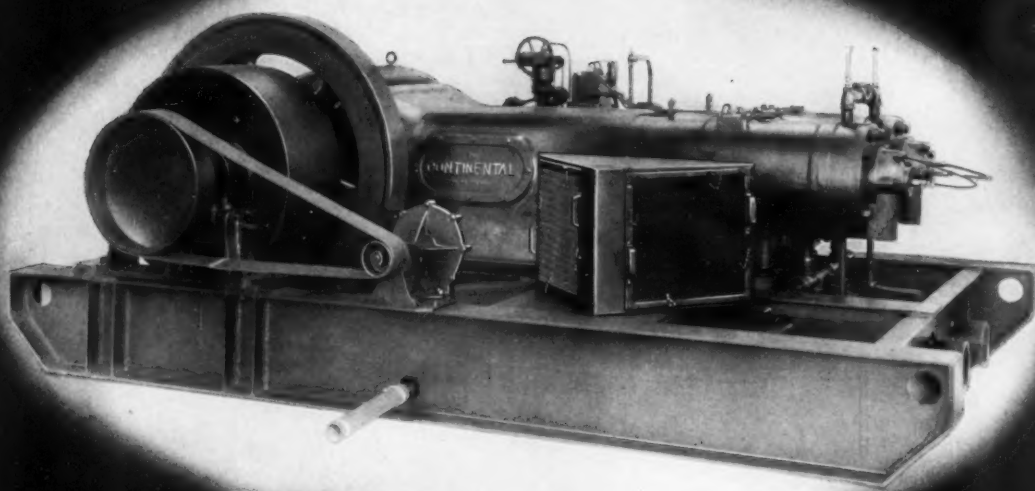
FRONT COVER ILLUSTRATION
— Joe E. Brown and Miss June Travis
featured in the new Warner Brothers-
First National picture, "Earthworm
Tractors." See article on pages 20
and 21.

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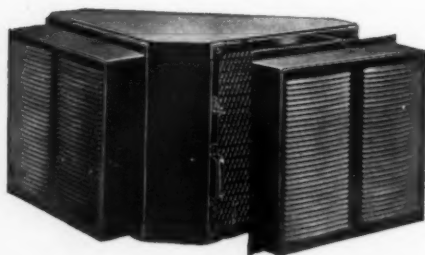
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Every S. C. F. Filter installation is guaranteed by us to be entirely satisfactory in every detail or the purchase price will be refunded. Practically every compressor and engine manufacturer in the United States recommends the use of American Air Filters.

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AMERICAN AIR FILTERS



DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

TULSA, Okla, May 23rd, 1936. As the Ninth International Petroleum Exposition draws to its close here tonight another segment of industry has been brought into the Diesel fold. Diesel engines dominated this huge industrial exposition. Everywhere you went you saw a Diesel in operation or on exhibit. The whole show talked Diesels and they were buying Diesels, for drilling, for pumping, for pipe line work, for tractors, winches, etc., etc.

I thought the Machine Tool Show in Cleveland last Fall was the biggest thing I had ever seen in industrial expositions. Then I saw the Road Show in Cleveland in January and figured I was looking at the last word in mass merchandising of heavy equipment. But I had not seen anything until I reached Tulsa. Twelve million dollars worth of equipment on exhibit, most of it in full operation. Nearly three million dollars worth of Diesel equipment on exhibition and two hundred thousand people passed through the gates.

It was an impressive sight to see this huge show, to talk with the exhibitors, to talk with the people visiting the show. It was a BUYING show, men came there to buy and they bought. Long after the regular closing time of 9:30 thousands of people lingered on, asking questions, keenly interested in the various exhibits. I got a picture of this huge oil industry here in Tulsa that I have missed before, the basic fact that this country, the whole world for that matter, revolves around and absolutely depends on the oil industry.

It was good to see how popular the Diesel has become amongst Oil Men, how readily and eagerly they are applying the Diesel's economy to their specific problems. Two years ago, at this same show here in Tulsa, you hardly could find a Diesel, today they dominate the show and you could spot the companies who had estimated and prepared for this Diesel demand and those who had missed the boat so-to-speak. We're in a fast moving era and our manufacturers are doing an outstanding job in keeping pace with developments by designing and building an ever changing and improved group of Diesel engines to meet ever-expanding markets, of which this Oil Industry is but one, but a big one.

Rex W. Wadman

THE GREEN DIAMOND

THE news of the month in railroad circles is the completion of the Diesel-electric streamline train *Green Diamond*, which has been built for high-speed operation between Chicago and St. Louis on the Illinois Central line. Thirty-five minutes will be clipped from the previous fastest running time between the two cities when the *Green Diamond* starts on a four hour and fifty-five minute regular daily schedule. A round trip will be made daily, leaving St. Louis at 8:55 a.m., arriving in Chicago at 1:50 p.m., and on the return departing from Chicago at 5 p.m., with arrival in St. Louis at 9:55 p.m. Two steam trains were previously required for this service. This is a five-car unit, articulated, mounted on roller bearings, completely air-conditioned. Built of steel and aluminum, the train is 330 feet long and weighs 230 tons, which is half the weight of a standard train of the same capacity. It will accommodate 120 passengers. Although the train will eventually operate over only 4 per cent of the railroad's mileage, it will be known to all friends and patrons of the railroad, and it will stand as a symbol of the spirit of progress and investigation which animates the whole Illinois Central System organization. In addition to rendering a new and attractive type of service on one of the most exacting and highly competitive railway runs in the United States, this train will be a rolling laboratory in which will be worked out principles affecting the development of future passenger transportation.

This innovation in central Mississippi Valley travel, built at a cost of roundly \$425,000, has been under construction for several months at Chicago in the plant of the Pullman-Standard Car Manufacturing Company, which company is a veteran in the construction of streamline trains, with the result that the Illinois Central's product embodies the best practices of earlier designs and the use of high-strength alloy material.

The power car, which makes possible the high speed, contains the main power-generating unit for driving the train, an auxiliary oil engine and generator for supplying current for lighting, battery-charging and operating air-condi-

tioning units and kitchen electrical appliances. In this car are also the air compressors, heating boiler, batteries and electrical control apparatus and water and fuel tanks. The power car equipment has been installed by the Electro-Motive Company at its new plant at LaGrange, Ill. The main power unit is a 1,200-horsepower Diesel engine furnished by the Winton Engine Company of Cleveland, O., which is also supplying the auxiliary engine. All the electrical equipment is furnished by the General Electric Company.

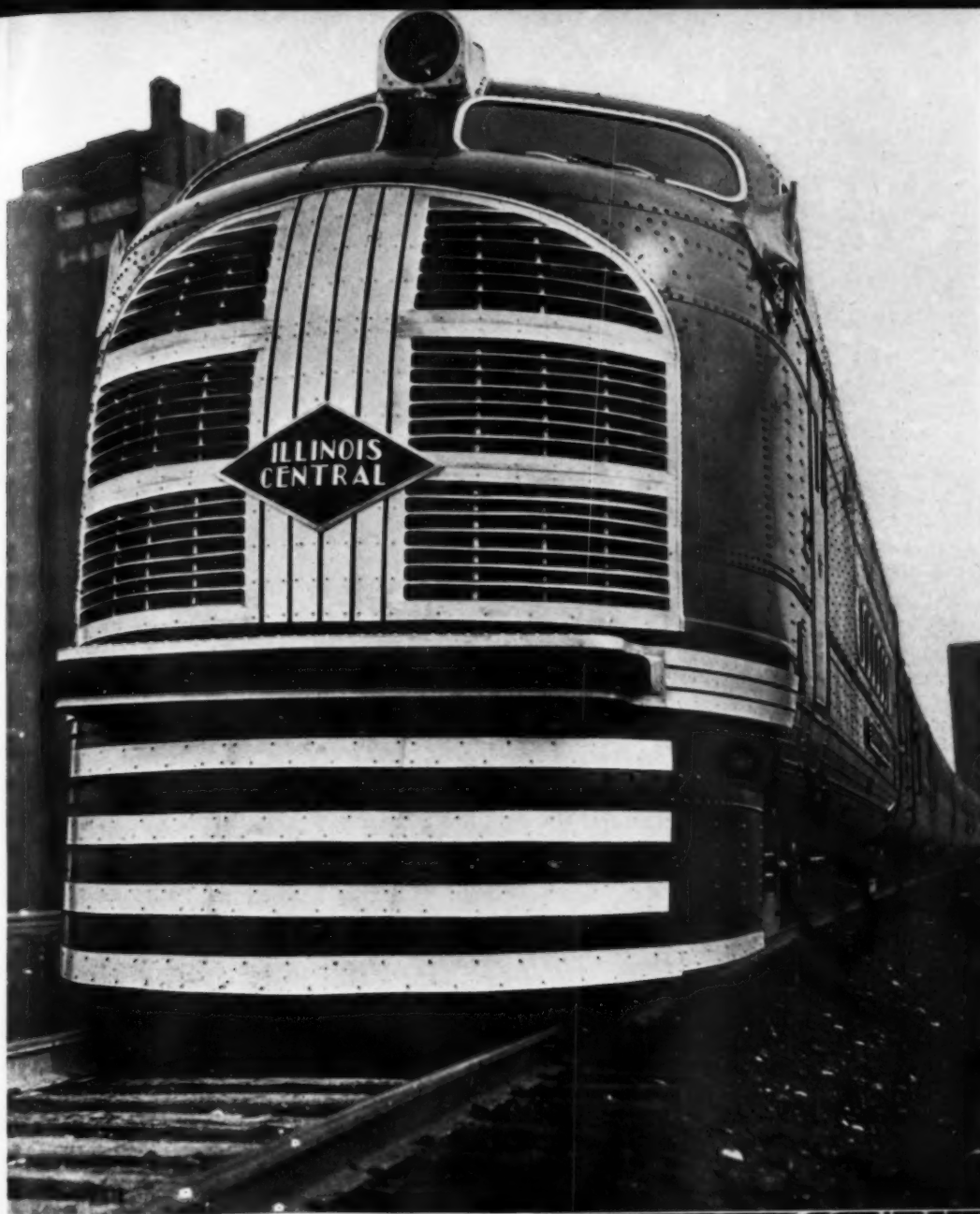
The train will accommodate its 120 passengers in individual seats, and has in addition twenty-four seats at six dining tables and two seats at a corresponding number of desks. It will also carry mail and baggage.

The cars, in order from front to rear, are the power car, the mail and baggage car, two chair cars and the kitchen-lounge-observation car. The first chair car contains fifty-six passenger seats; the second chair car contains forty-four passenger seats and sixteen places at four dining tables; the lounge car contains twenty portable chairs for regular passenger occupancy,

eight dining seats at two dining tables and two desks with chairs to correspond.

The main engine is a V-type, 16 cylinder, high-compression, 2-cycle Winton Diesel engine of 8-inch bore and 10-inch stroke, rated 1,200 hp. at 750 rpm., protected by an Alnor pyrometer. Power for all auxiliaries driven by the main engine, directly or indirectly, is taken from the power plant in excess of its rating. The cylinder block and crankcase have been combined into one unit of the latest welded steel construction and the engine base is of a unique design. This structure incorporates in a single welded steel assembly a sub-base for mounting the coupled engine and generator and a fuel supply tank. Power produced by the prime mover is delivered to the driving wheels through an electrical transmission consisting of generator, traction motors and PCL control apparatus. This equipment is supplemented by a storage battery and an auxiliary battery-charging generator. The generator furnished with the transmission equipment was designed to provide a characteristic most suitable for this particular engine. Four 300 hp. traction motors, carried on the first and second trucks,





are of the self-ventilated type. Clean air is supplied from inside the car body through flexible air ducts supported between the motor and the car underframe. A 32-cell, 25-plate Exide battery is installed to supply power for engine starting, transmission control, cab and engine room lights and emergency train lights.

It has a capacity of 450 a.h. at the 10-hour discharge rate. The power plant equipment also includes a small 110 hp. Diesel-electric power plant, which is provided to supply auxiliary power for the battery charging and the train line auxiliaries. This auxiliary unit consists of a high-compression Winton Diesel rigidly coupled to a 60 kw., 220-volt, 3-phase alternating current generator. The driving engine is similar in design to the main engine and is rated at 110 hp. at 1,200 rpm.



STOVES MADE FOR LESS—WITH DIESELS

WHILE power is one of those essential items entering into the manufacture of various commodities, too often the importance of a dependable, low-cost source of supply is overlooked. There are also many instances where little or no thought is given as to how much the cost of power enters into the cost of manufacture. The possibilities of interruptions of service and their results are not considered until they actually occur.

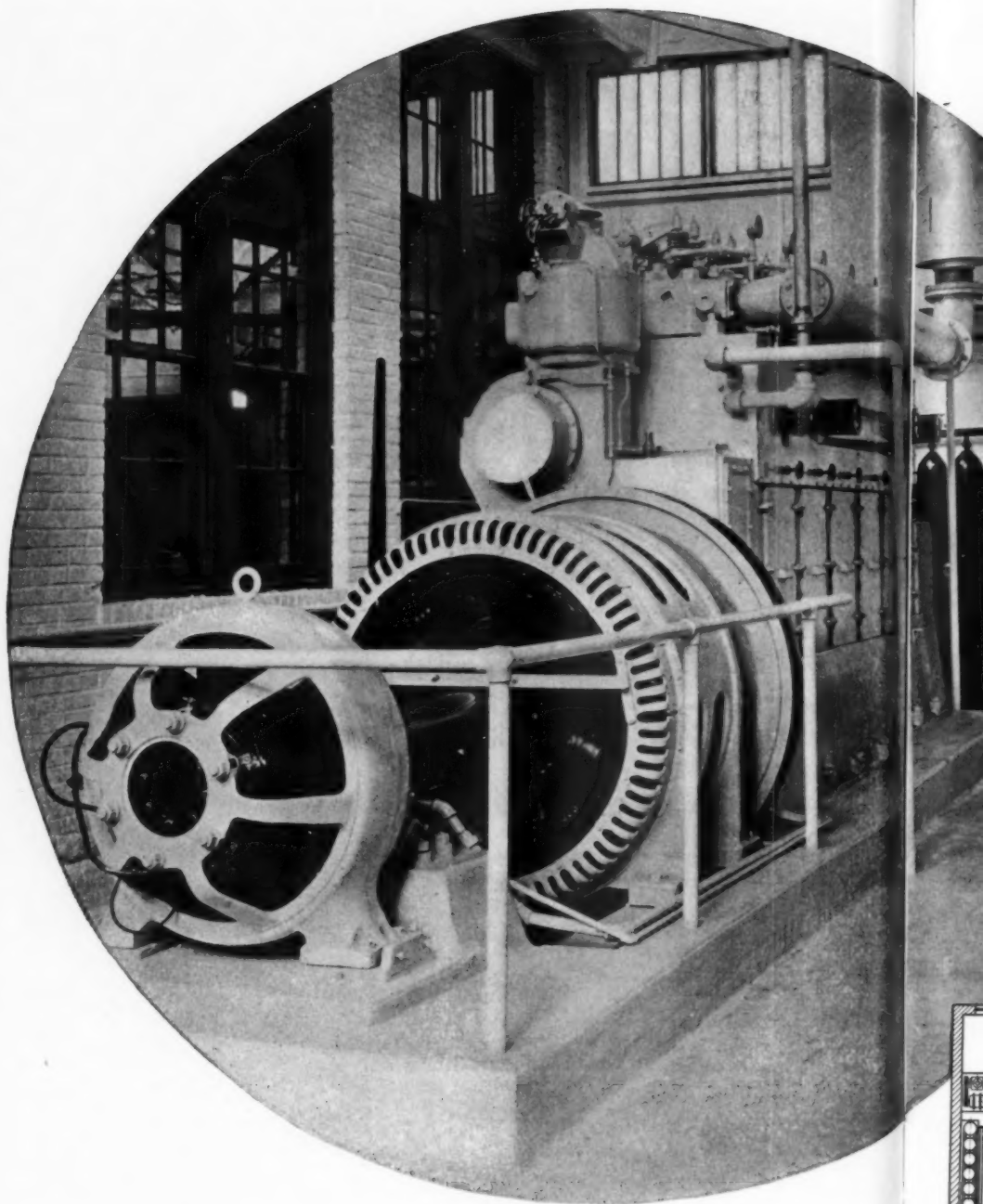
Not so, however, with the Quincy Stove Manufacturing Company of Quincy, Illinois, manufacturers of the well-known line of MONO-GRAM stoves and ranges. This company has about two hundred employees, and operates various departments such as foundry, machine shop and sheet metal, enameling and assembly shops. Because power was a secondary item in the making of stoves, it was quite natural that in the early years of the company's existence power was purchased just the same as other raw materials. This practice is quite common with a great many small companies.

During the period of changing times, which has affected many business enterprises, the necessity for reducing all costs became a matter of considerable importance. One of the steps taken by the Quincy Stove Manufacturing Company in their endeavor to reduce operating expenses was an investigation of the possible saving that would result from the installation of their own power generating equipment. An estimate was made as to the cost of producing power; and when compared with that of purchased service, a Nordberg Manufacturing Company 300 hp., 6-cylinder, 4-cycle, mechanical injection Diesel engine was installed. This engine was direct-connected to a General Electric 244 kva., 440-volt, 25-cycle generator.

The power load at the Quincy Stove Plant consists of 95 motors, ranging in size up to 100 hp. The total connected motor load is 375 hp. There is one 75 hp. and one 100 hp. synchronous motor, each driving an air compressor. During the day shift the ordinary shop load exists, with the 100 hp. motor driving an air compressor. During the night shift the load increases because of the heavy foundry demand when both the 100 and the 75 hp. compressors are in operation. As a rule, the night load is heavier than the day load and continues

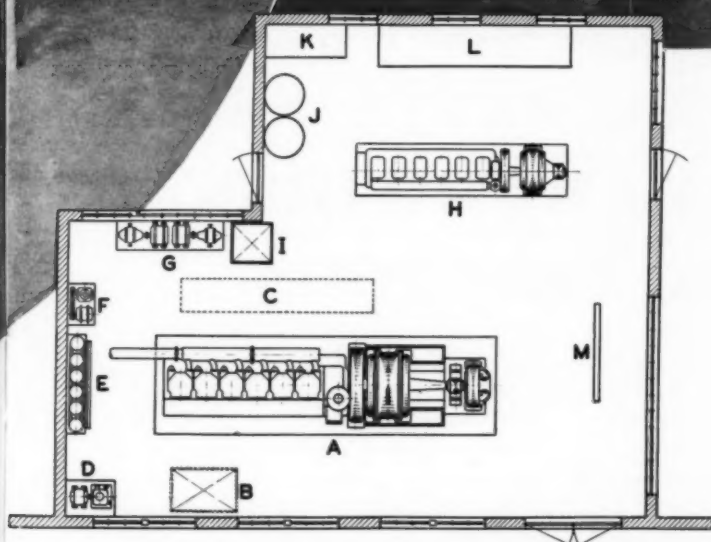
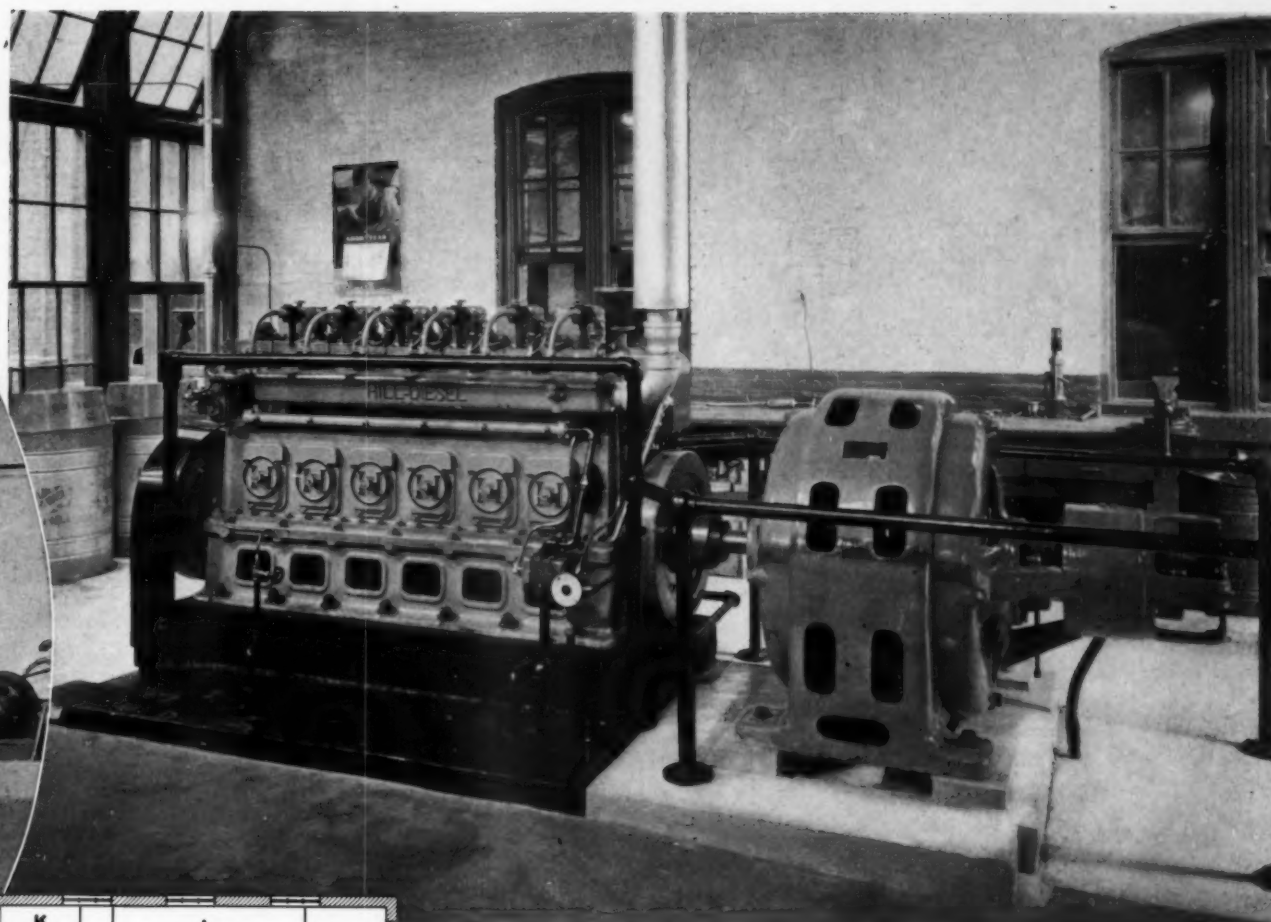
from 17 to 18 hours, 6 days per week. This gives a favorable load factor; and with the two synchronous motors, the power factor is maintained at approximately 94 per cent.

The work of installing this Diesel unit started in late 1933. The site selected for the engine room was a court between two buildings, about centrally located with reference to the plant as a whole. Two existing walls of the two adjacent buildings were utilized, and the two new walls were largely of glass, to afford ample



Quarter view of the Nordberg Diesel and General Electric generator.

Top, Right—The Hill Diesel auxiliary set which carries off-peak loads.



Layout of power plant, showing location of power generating units and auxiliary equipment.

- A. Nordberg Diesel Engine.
- B. Daily fuel service tank for Nordberg engine.
- C. Hot well.
- D. Hydroil purifier.
- E. Starting air bottles and tool board.
- F. Starting air compressor.
- G. Cooling water pumps.
- H. Hill Diesel engine.
- I. Daily fuel service tank for Hill engine.
- J. Lubricating oil supply.
- K. Locker for spare parts.
- L. Work bench.
- M. Switch board.

natural light. The engine room measures 30 by 36 feet. Late in 1935 a small auxiliary Hill Diesel engine was installed to furnish light and incidental off-peak loads after midnight and Sundays. This unit is 40 kw. capacity.

When installing the Nordberg engine, advantage was taken of the waste heat in the exhaust gases by enclosing the Maxim silencer, which is located above the engine, in a sheet metal jacket and running a duct from this jacket to one of the adjacent work rooms of the plant.

A suction fan was installed, which draws the hot air from this muffler jacket and thus heats a part of the shops.

In one corner of the engine room is a Gould-Hydroil Centrifugal Purifier. Lubricating oil is centrifuged once a day for a two-hour period. A complete oil change is made every six months. The Diesel is further protected by an Air Maze filter.

The cooling water system consists of a 2,000-gallon hot well located beneath the engine

room floor, a circulating pump and a cooling tower on the engine room roof. Water from the hot well is lifted by a 1½" Dayton-Dowd pump, having a capacity of 180 gallons per minute at a 40 ft. head, and is driven by a 5 hp. motor. This pump discharges into a Lilie-Hoffmann atmospheric spray and deck type cooling tower. This is entirely of red cypress construction, and has a capacity of 60 gallons per minute with a temperature drop from 120 to 90 degrees F. It occupies a space 6'-0" by 8'-0", and is 12'-0" in height. From the tower water flows by gravity to the engine.

Air for starting is provided by a Quincy compressor with a capacity of 8 cubic feet per minute at 400 pounds pressure. Air is stored in four bottles.

Fuel oil is delivered by tank car to a 9,000-gallon underground storage tank. From here the oil is transferred by pump to the daily supply tank of 200 gallons. Before passing to the fuel pumps, it is filtered through a built-in oil filter. Oil is purchased having a gravity A.P.I. of 30-36.

For more than two years the Nordberg Diesel . . . And now please turn to page 50



Diesels are SO economical says Joe E. Brown, you can feed 'em fuel through an eye dropper or the smallest of oil cans.

ALEXANDER BOTTS SELLS SOME EARTHWORM DIESEL TRACTORS

EVERYONE who reads the *Saturday Evening Post* has read the famous "Earthworm Tractor" stories by William Hazlett Upson. Followers of these famous short-stories have come to know "Alexander Botts," Upson's whimsical chief character, the egotistical and often pitiable tractor salesman who commits astounding and laughable blunders, but who always wins out in the end.

Now, in Warner Brothers-First National's production of "Earthworm Tractors," starring Joe E. Brown, "Alexander Botts" is brought to life on the screen. The inimitable, broad-mouthed Joe makes an ideal "Botts" and, supported by a splendid cast of first-rate screen artists, turns out a laugh-a-minute comedy of high entertainment value.

On the Editor's recent visit to the Pacific Coast

he spent some time on the Warner Brothers lot witnessing some of the scenes in this hilarious moving picture. Believing that many of our readers have followed the varying fortunes of Alexander Botts through the pages of the *Saturday Evening Post* and because Caterpillar Diesel Tractors (re-named Earthworm Diesels for their debut in pictures), are used in this movie, we illustrate herewith some shots from the picture and give a brief synopsis of the so-called plot.

Alexander Botts (Joe E. Brown) fancies himself in love with Sally Blair (Carol Hughes) and his romantic competition is Emmett McManus (Dick Foran). Both Botts and McManus are salesmen; neither very successful. Botts, in fact, is peddling trivial little novelty gadgets. Coaxed by Sally and by her father (Olin Howland) who urge him to "sell some-

thing big and important," Botts decides to sell huge "Earthworm" tractors, to make a success, and then return to claim Sally's hand.

His monumental assurance enables him to get an assignment from the Earthworm officials as a mechanic-assistant to George Healy (Craig Reynolds) whose assignment has been to sell tractors to Mr. Jackson (Addison Richards) a lumber dealer.

Botts, who often confuses names, gets mixed up and when Healy, through a comic mistake, drinks hair tonic and passes out, he starts out to sell a tractor. Through a mixup, he tackles Cyrus Johnson (Guy Kibbee) instead of Jackson, meets Mabel Johnson (June Travis), charming daughter of the querulous and hard-of-hearing old Johnson, a small-time business man.

Botts starts his "Happy Hooligan" mistakes and laugh-provoking blunders immediately, and his efforts to sell old Johnson a tractor get him in more hot water. Bills, for his damage accidents, also pour into tractor headquarters and Healy is fired by wire — also Botts. But Jackson, whom Botts was supposed to have sold tractors to at first, buys several machines and Botts is kept on the payroll.

Botts has been attracted by Mabel Johnson and she has taken a liking to him. He, however, figures it's impossible to sell her father any tractors. She encourages him to try again, however, and he agrees. Then follows Botts' wildest blunder when he hooks a tractor to the Johnson home and moves it while old Johnson is still in it, and before the lights, gas and water have been disconnected for a planned house-moving.

Despite his blunders, Mabel has grown fond of Botts, but she's piqued and hurt when he confesses he has promised to go back and marry Sally Blair. Botts, whose proudest assertion is that he always keeps his word, goes back to claim Sally, though it is plain he's in love with Mabel. But he finds Sally already married to Emmett McManus. So he rushes back to marry Mabel and finds she has gone away to the city.

The conclusion of the story, rip-roaring with exciting dramatic action, always tinged with comedy, comes when blundering Botts drives into a series of dynamite explosions with old Johnson aboard the big "Earthworm." The explosions cure Johnson's deafness, and Botts heroically saves Mabel's life. Botts and Mabel go into a clinch as old Johnson announces he's going to buy twenty-two tractors from his son-in-law to-be.



Three talking pictures. Guy Kibbee does a grand job of facially expressing a buyer's resistance. Miss June Travis adds tremendously to the scenery.





“BREATH OF HELL”

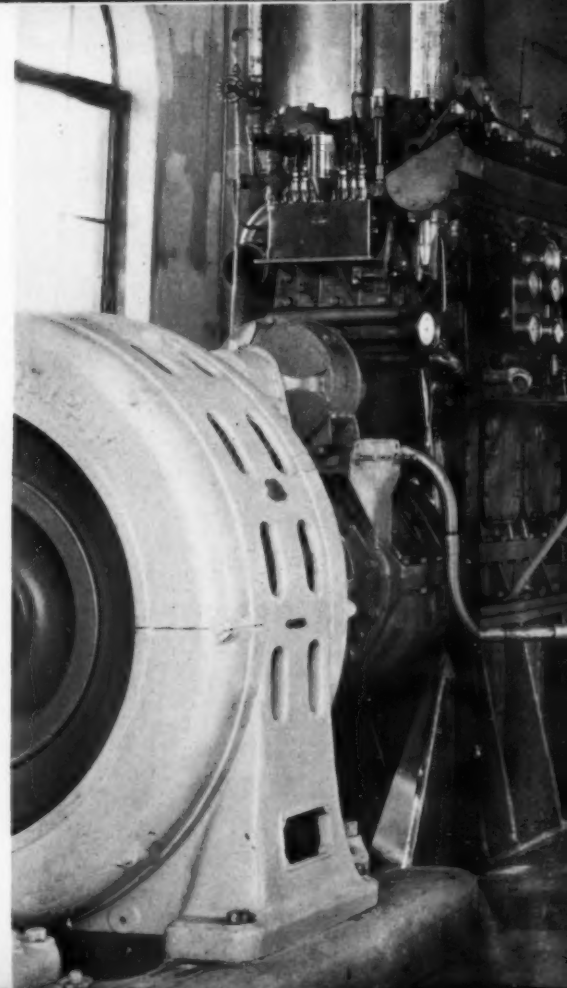
*The Application of Diesel Engines to
“The Devil’s Kitchen” Yields Dry Ice*

AT the south end of the Salton Sea in the Imperial Valley of California and two hundred feet below sea level is located one of nature’s strange eruptions known as “The Devil’s Kitchen.” This phenomenon is a cluster of mud geysers fuming and sputtering with evil-smelling gases.

The Devil’s Kitchen stewed along through the ages unmolested except for brief visits by curious travelers until recently when a chemically inclined woman named Mrs. Mary Einhart came along, pondered the basic reasons for

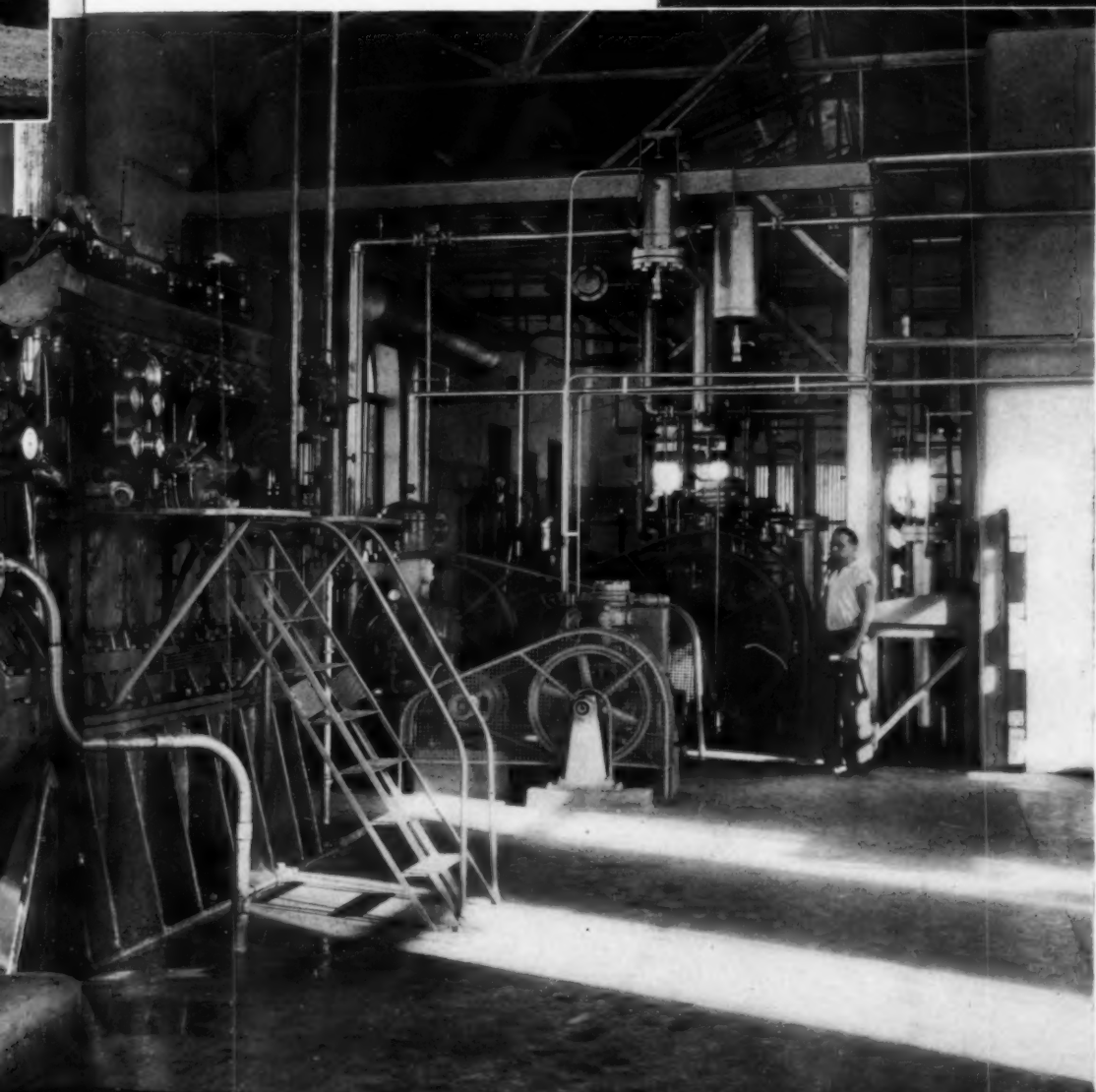
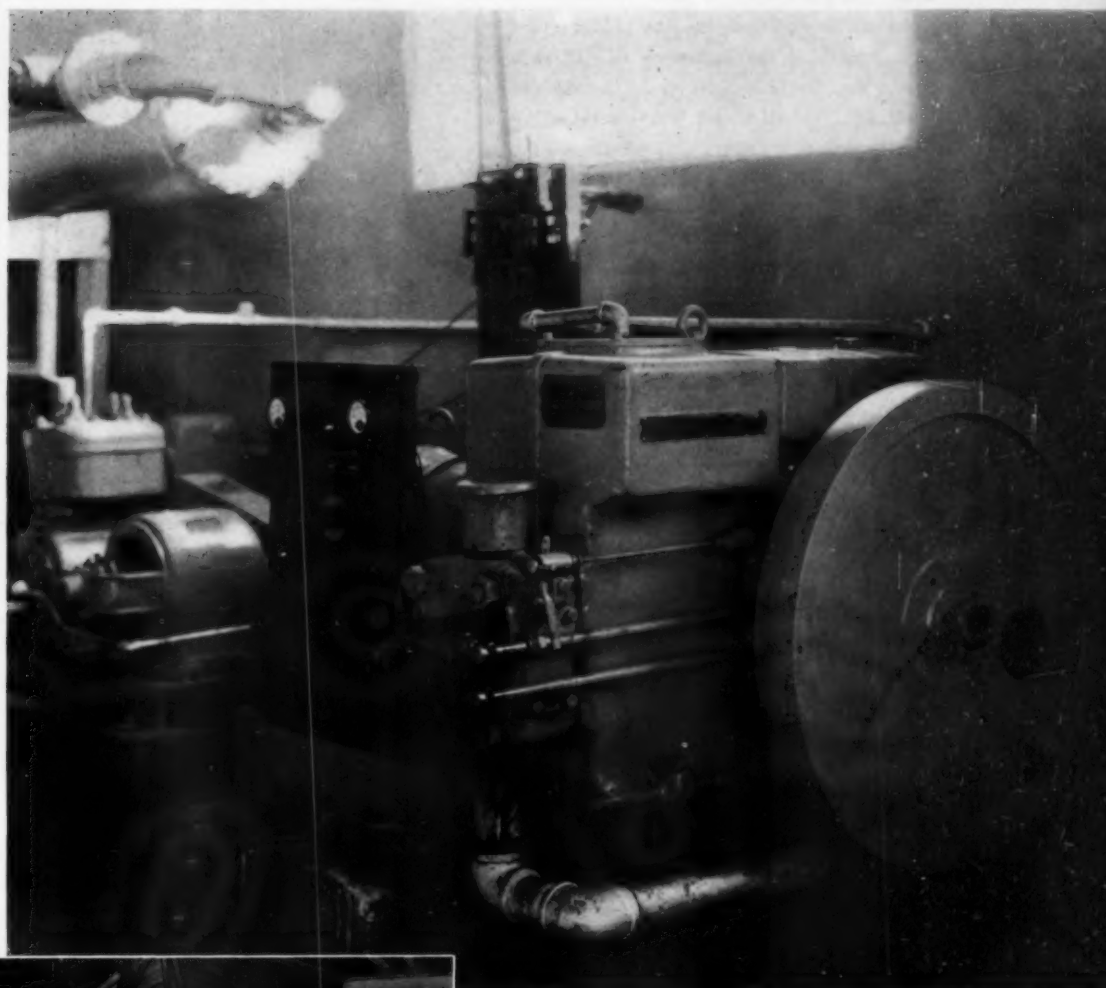
this unusual disturbance and wondered what, if anything, could be done to utilize the gas commercially.

On her next visit, Mrs. Einhart brought a small jug in which she trapped a sample of the escaping gas. Upon analysis it was discovered to contain a high percentage of carbon-dioxide generated as a result of hot salt water flowing over lime stone deposits. This revelation immediately suggested a profitable enterprise, capital was raised, wells were sunk, compressors and Diesel engines were installed and the





The plant, the product and the Diesel engines. Left - 10 hp. Bromfield Deutz. Below - 300 hp. Cooper-Bessemer.



Pacific Imperial Dry Ice Company began operations.

Dry ice as a product of the chemical laboratory is not new but, as a commercial industry, it dates back only to 1928 or 1929 according to officials of the Liquid Carbonic Corporation which has twenty-four plants in the United States and Canada producing about 100,000,000 pounds annually. Ninety per cent of this output is used by the ice cream manufacturers and distributors at present but it is gaining wide favor and recognition as a truck refrigerant. The most important feature of dry ice in truck transportation, of course, is the great reduction in weight and space compared to ordinary ice of the same refrigerating capacity. To illustrate specifically, 95 pounds of dry ice provides cooling of perishable cargo equal to 1,200 pounds of regular ice and 300 pounds of salt. The available increase in truck payload is obvious.

In addition, dry ice eliminates many re-icings . . . And now please turn to page 55

WHILE yardage records reach new highs on the major construction jobs almost every month, matching the increasing size of each new project, the keen observer of the modern Diesel engine power trend is not overlooking the important part the Diesel is playing on the American farm, and in the foreign fields of agriculture as well.

For, after all, introduction of the Diesel tractor was perhaps of greatest benefit to the cost-harassed farmer. Truly, for him, it was the product of necessity, and it came at a time when the curve of farm produce prices was nearing the bottom of its sickening dive. And although that indicator had been sorely afflicted with sinking-sickness, the line showing the trend of farm power operating costs had continued on its skyline highway course.

In was in the fall of 1927 when an American manufacturer produced the first Diesel tractor to be made in this country.

There are three principal reasons for Diesel tractor acceptance that has brought a new era to agriculture:

1. The Diesel tractor has sliced from one-half to two-thirds from the former per-acre operating costs;
2. It has not only brought low cost tillage, but has become a very effective weapon in striking down the farmer's worst enemy, soil erosion by wind and water;
3. It has lightened the farmer's field burden because of its adoption by the "contract farmer," who now can tend his clients' crops at a per-acre fee which is less than they would expend if they, with ordinary equipment, did the job themselves.

The Allen Newlin farm near Hutsonville, Ill., in the Wabash River valley, is typical of the results obtained from a swing to Diesels. Carl A. Newlin, manager of these extensive farm-lands, tabulates closely his costs and keeps a modern accounting system. In April, 1935, the farm purchased a Diesel tractor of 44-drawbar horsepower. This Diesel went through the round of field and belt tasks last year. On November 2, Manager Newlin issued the following report, a comparison between Diesel and former power costs:

Typical view on a western ranch which is farmed entirely with McCormick-Deering Diesel tractors.



Ditching is but one of many uses that farmers find for Allis-Chalmers tractors.

DIESELS IN AGRICULTURE

Balancing The Farmer's Power

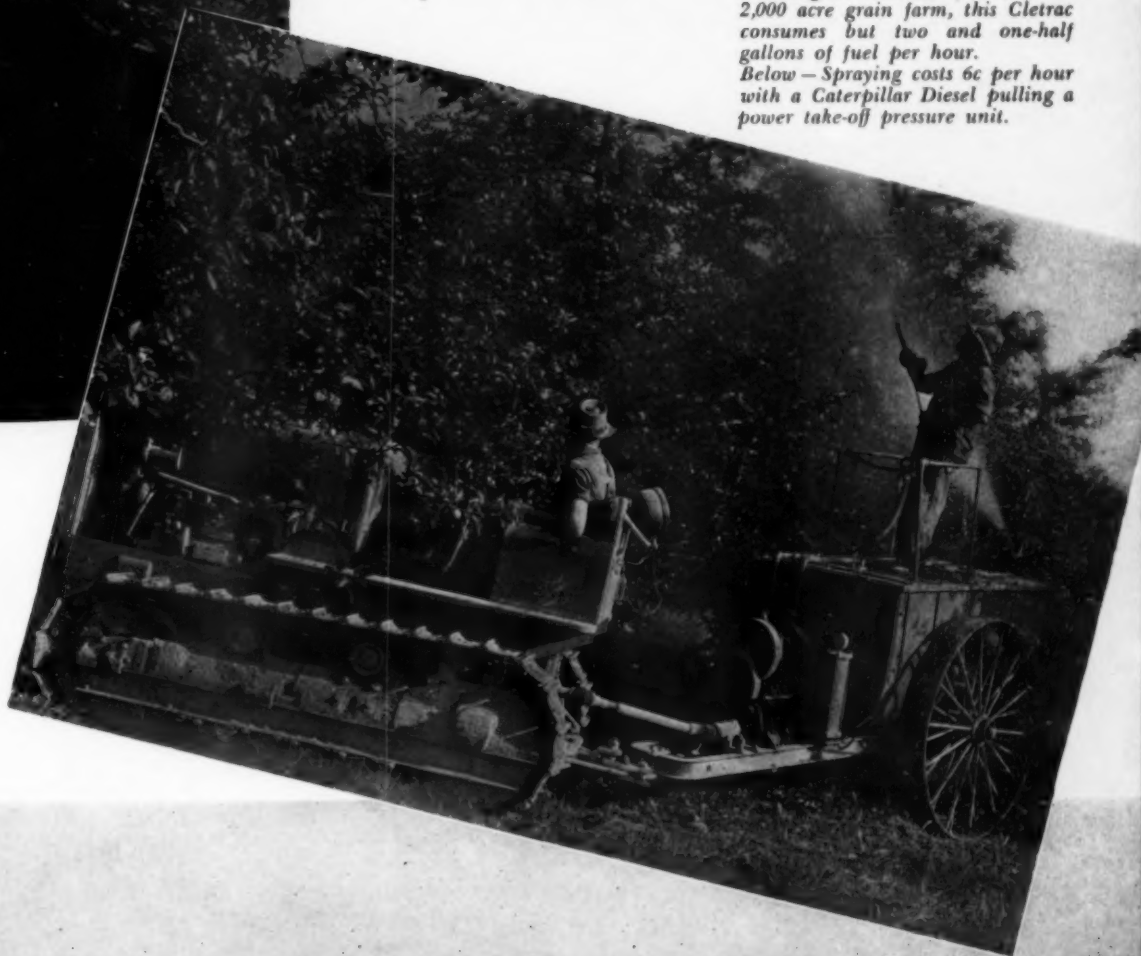


AGRICULTURE

er's Power Budget



Working on summer fallow on a 2,000 acre grain farm, this Cletrac consumes but two and one-half gallons of fuel per hour. Below — Spraying costs 6c per hour with a Caterpillar Diesel pulling a power take-off pressure unit.





The Diesel plowed 1,400 acres of corn and wheat land, double disked and harrowed, and dragged this acreage. To accomplish this assignment, the tractor worked around the clock, piling up a total of 1,500 hours, and despite an unusually wet season, got out all of the corn. In addition to the field work, the Diesel worked 145 hours combining and 95 hours threshing wheat, 65 hours at the elevator and 195 hours on the sawmill. By November, the tractor had totaled approximately 2,000 operating hours. Checking the report showed that the Diesel had consumed exactly 3,485 gallons of fuel oil during this operation.

"On a comparative basis with our past experience, we have replaced three 3-plow tractors with our Diesel. The Diesel consumed the same gallonage of fuel per hour as one of our 3-plow tractors," the manager explained. "The cost of fuel for the Diesel is half the cost of fuel used in our old tractors. So to get the same work done with the Diesel, our fuel cost has been reduced to one-sixth of our former expense.

"The Diesel tractor has about the same oil consumption as one 3-plow tractor which made our oil cost one-third. We also experienced considerable labor saving in field work." Manager Newlin presented the following summary of savings:

Fuel savings	\$1,463.70
Lube oil savings	133.00
Labor savings	900.00
Total 1935 season	\$2,496.70

Exemplifying the enthusiasm with which the Diesel tractor was received throughout agricul-

tural North America is a tribute from the colony of Hutterian Brethren at Glenwoodville, Alberta. Here again, close operation records are kept and charted.

From these may be taken the harvest cost figures for 1934 and 1935. During the former season a tractor burning fuel costing 10 cents a gallon was used. Last year, however, the colony purchased a Diesel tractor of 40 horsepower. The same harvester was used both years, pulled by the Diesel's predecessor in 1934. Both seasons were 13 days long, according to Jacob Hofer of the colony, and conditions were almost identical. But there the similarity ends. The tractor used during the 1934 threshing season in 1934 burned 585 gallons of tractor fuel, a cost of \$58.50. Lubricating expense was \$25.90. In the 1935 season, the Diesel consumed 300 gallons of 5-cent fuel oil, a cost of \$15.00. Lubrication cost was \$14.52.

During the thirteen 12-hour threshing days, the Diesel harvested 30,000 bushels of wheat. In the same time, the preceding year, the tractor-fuel burning machine harvested only 25,000 bushels. And the Diesel did the job at one-third the former operating cost!

This low operating cost of the Diesel tractor has attracted many new jobs in the many branches of agricultural work. Belt jobs powered by the tractor may now be accomplished at small cost, whereas before the advent of the Diesel this expense was prohibitive. The farmer now uses his Diesel tractor throughout the year and the many jobs include orchard And now please turn to page 44

Combining in the West with a McCormick-Deering Diesel tractor and harvester-thresher.

Right - Terracing on California Soil Conservation Project with McCormick-Deering Diesel TracTracTor.

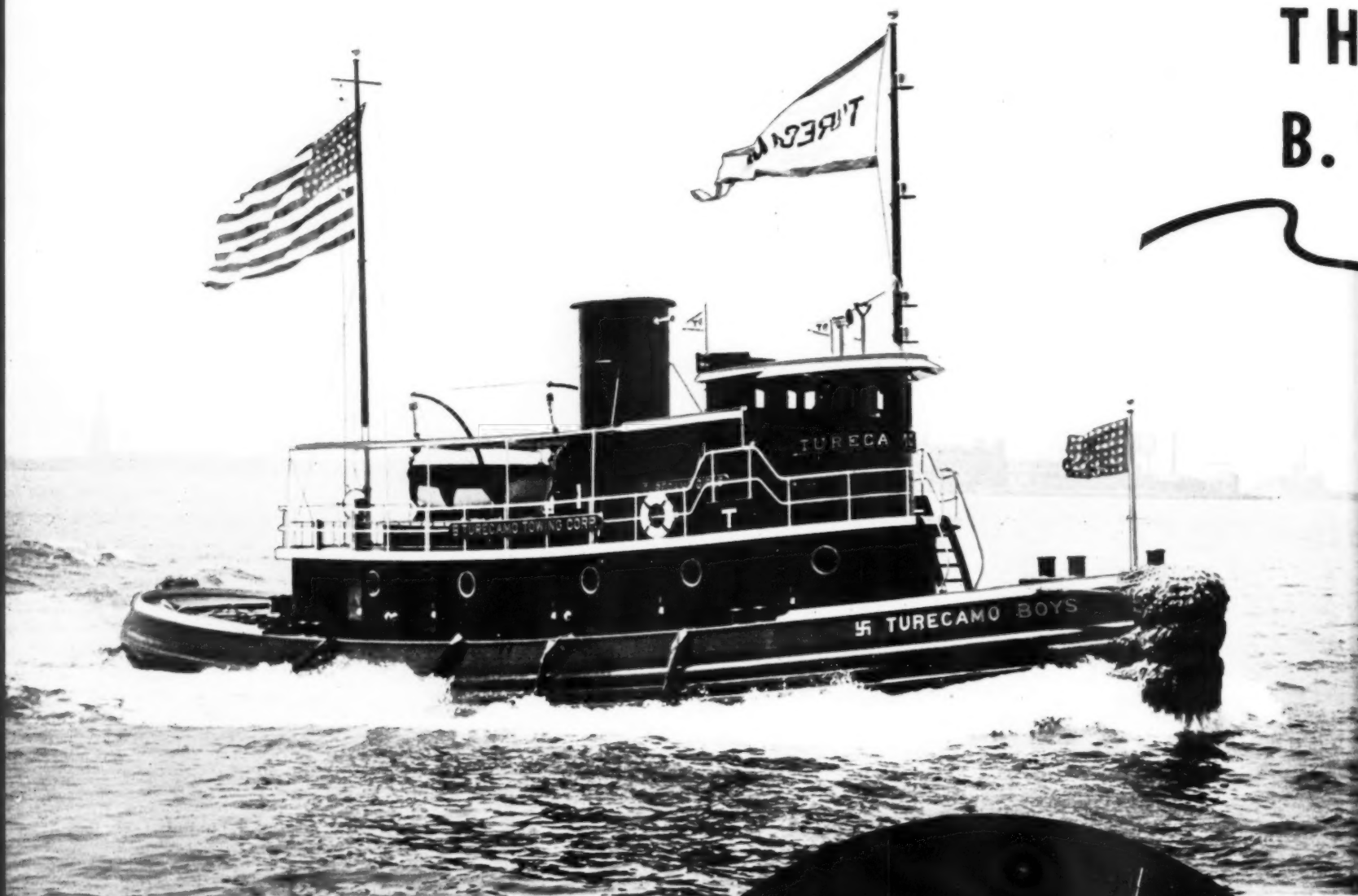
Lower Right - Caterpillar wide gauge Diesel tractor successfully working steep hillsides on the Braden ranch near Walla Walla, Washington.

Cletrac Diesel spray outfit in operation at San Jose, California. The owners once held the world non-stop tractor title.

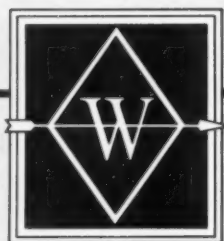




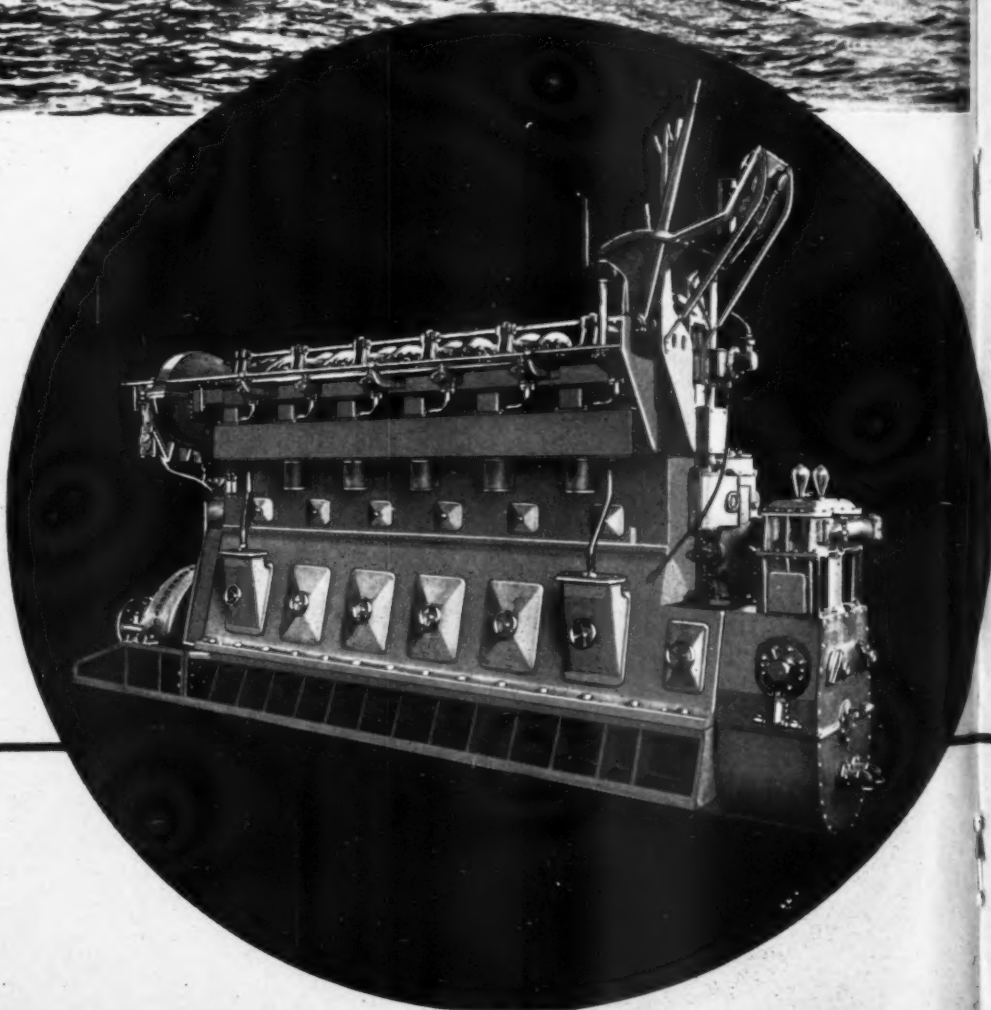
THIS
B. TU



Six-cylinder, 600 b.h.p.
Winton-Diesel engine
installed in the new
workboat Turecamo Boys



Symbol of Economy
and Dependability



THIS TIME IT'S "*Boys*" AT THE B. Turecamo Contracting Company

The B. Turecamo Contracting Company, Brooklyn, N. Y., placed their first Winton-Diesel workboat, *Turecamo Girls*, in service some three years ago. Since that time this boat has distinguished itself by its outstanding performance and economy in operation. The owners will shortly place in service their second Winton-powered towboat, the *Turecamo Boys*, a duplicate of the *Turecamo Girls*. The new tug, 93 feet in length, was designed by Merritt Demarest and is being built by the Rice Bros. Shipyards, Boothbay, Maine. It is powered with a six-cylinder Winton-Diesel engine developing 600 b.h.p. at 250 r.p.m. . . . demonstrating again that given the opportunity to prove their superior performance characteristics, economical and dependable Winton-Diesel engines are invariably specified by the owner for installation in subsequent craft to carry his name.

WINTON ENGINE CORPORATION
C L E V E L A N D , O H I O , U . S . A .



Dornier "Do 18" Mailplane with two 550 hp. Junkers "Jumo" 205-C Diesel engines.

SOUTH ATLANTIC AIRMAIL SERVICE

Dornier "Do 18" Flying Boat with Two Diesel Engines

By PAUL H. WILKINSON

THE Dornier *Do 18* flying boat, powered with two 550 hp. Junkers *Jumo 205-C* Diesel engines, has recently been placed in service by Deutsche Lufthansa on the South American airmail route. Designed to replace the larger and heavier Dornier *Wal*, which was powered with two 600 hp. B.M.W. *VI* gasoline engines, the *Do 18* is considerably faster and much more economical to operate.

Airmail received in Berlin on Wednesday arrives in Buenos Aires on Sunday, this service operating alternately on a bi-weekly basis with that of Air France. The new mailplanes are at present operating on the South Atlantic hop between Bathurst, British Gambia (on the west coast of Africa) and Natal, Brazil. They are designed for catapulting from ships stationed at each end of this section of the route, which, it is claimed, permits a 25 per cent greater load to be carried than if they had to take off from the water.

The passenger service between Germany and

South America is well taken care of by Deutsche Zeppelin Reederie, operating the *Graf Zeppelin* and the *Hindenburg*. Consequently, the mailplanes are comparatively small, but very efficient for the purpose. The *Do 18* carries a crew of four—pilot, assistant pilot, radio operator and mechanic—and a normal load of mail and express weighing 330 lbs.

The *Do 18* is of all-metal construction, with a semi-cantilever wing which is supported in the center by a narrow streamlined turret on top

of the hull and braced with struts from sponsons on each side of the hull. The turret also serves as a support for the engine nacelle containing the two engines.

The hull consists of a framework of extruded duralumin sections covered with sheets of the same material. It is divided into eight watertight compartments. The underwater part has a single step just behind the center of gravity, and a small water rudder for use when taxiing on the water. Above the waterline, the



hull is rounded and streamlined as much as possible, all fittings being countersunk.

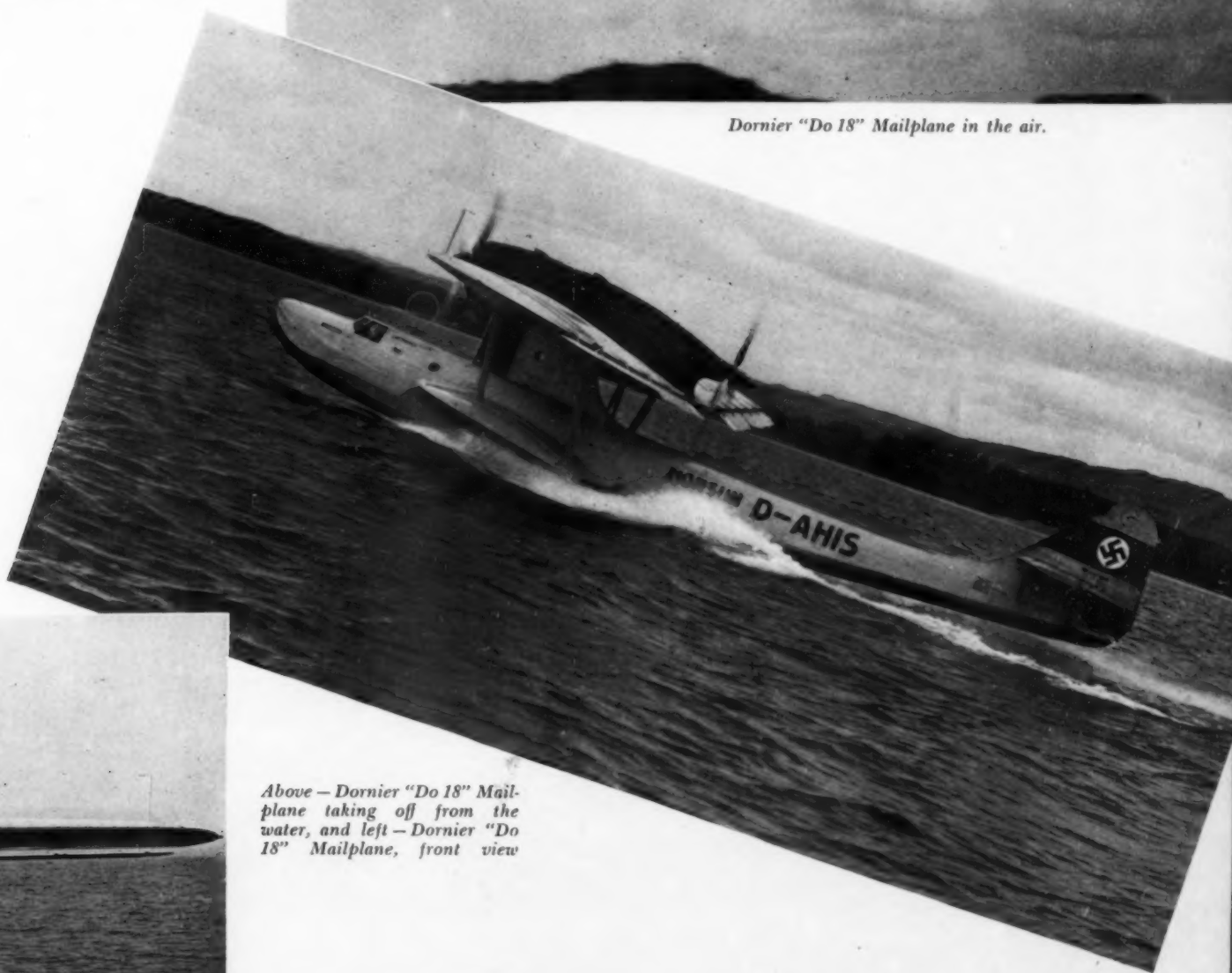
In the bow compartment, ample space is provided for storing the marine equipment. Behind this is the enclosed pilots' compartment, which is equipped with dual control and is entered through the two hinged top windows. From the pilots' compartment, a passageway extends to the rearmost compartment, behind the wing, in which the mail and express are carried. Directly behind the pilots' compartment is the radio and navigation room, which contains the usual radio and direction finding equipment and a large table for maps.

The fuel tanks are located aft of the radio room and comprise four aluminum tanks with a capacity of 165 gals. each, making the total load 660 gals. of Diesel fuel. These tanks can be removed if necessary through a screw-down hatch on the deck. The fuel installation is provided with dump valves. Additional lubricating oil and water tanks are also located in the hull.

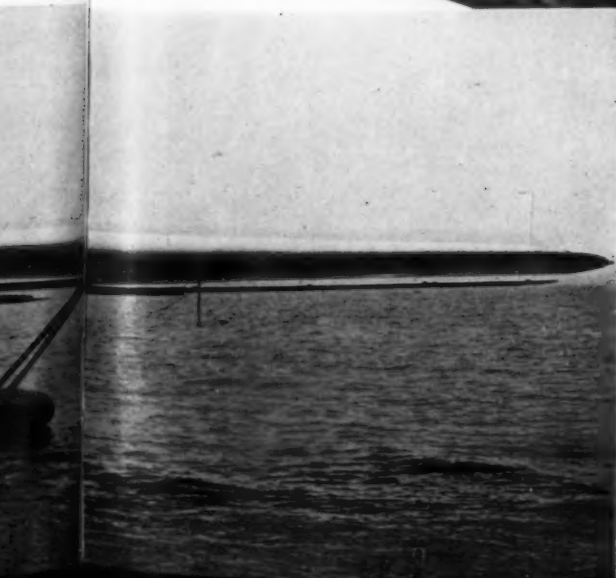
The two water-cooled engines are arranged in And now please turn to page 54



Dornier "Do 18" Mailplane in the air.



Above - Dornier "Do 18" Mailplane taking off from the water, and left - Dornier "Do 18" Mailplane, front view



PIPE DREAMS AND DIESEL REALITIES

By MISS SUE BARRETT

SINCE the beginning of time men of achievement have been dreamers. In olden times Columbus dreamed that the world was round, and in recent years Frank Weymouth dreamed that the billions of gallons of water flowing to the sea in the Colorado River could be diverted and used to change the arid desert wastes into valuable producing land and also supply Los Angeles and other Southern California cities with an inexhaustible supply of water.

The Metropolitan Aqueduct, largest construction project of its time, with its 226 miles of

main line to Cojalco, plus 155 miles of feeder lines, including 110 miles of tunnels, 153 miles of grade conduit, and 69 miles of pipe line, was the result of these dreams. Building this Aqueduct through valuable orchards, without destroying hundreds of acres of fruit trees and vineyards, was one of the main problems of construction. Many methods were considered and finally it was decided that if reinforced concrete pipe could be made 15 feet in diameter, and in section lengths that would be of a weight possible to get machinery to handle it, this division of the Aqueduct could be constructed by removing fruit trees and top soil





Miss Barrett, who weighs only 110 pounds, experiences no difficulty in driving these Diesels hauling a 65 ton load over improvised roads.

and immediately replacing them after the pipe line had been submerged. A precast pipe section 14 ft. 8 in. in diameter and 12 ft. long, weighing approximately 45 tons, was decided upon.

It fell to the lot of the American Concrete & Steel Pipe Company to invent machinery to manufacture the largest concrete pipe ever made in the history of the world.

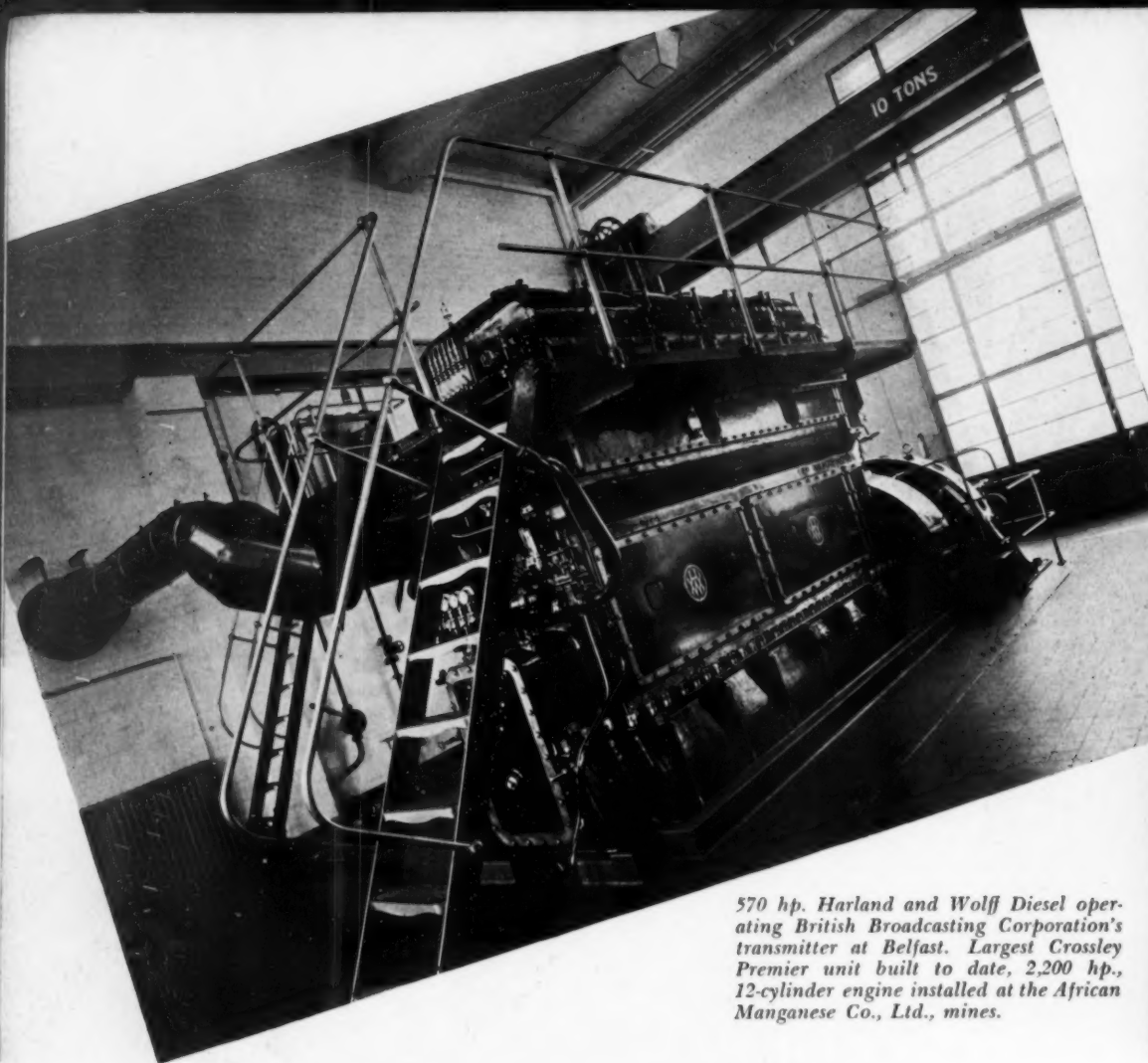
This section of the Aqueduct passes through the great Italian Vineyard, notable for its drifting, sandy soil, which presented a serious transportation problem. Two Sterling Diesel dual chain drive tractors and utility 50 ton low bed semi-trailers were purchased and have proven highly successful. The road was made by running a blade grader through the sand along the pipe line right-of-way and sprinkling with water. These tractors are able to carry their gross load of 129,000 pounds at a speed of 20 mph. They are powered with Cummins 125 hp. Diesel engines.

This contract consists of a ten mile section of the Aqueduct, with the plant located at Rochester station, in the center of the job—the longest haul being 5 miles each way from the plant. The pipe is loaded by being rolled And now please turn to page 48

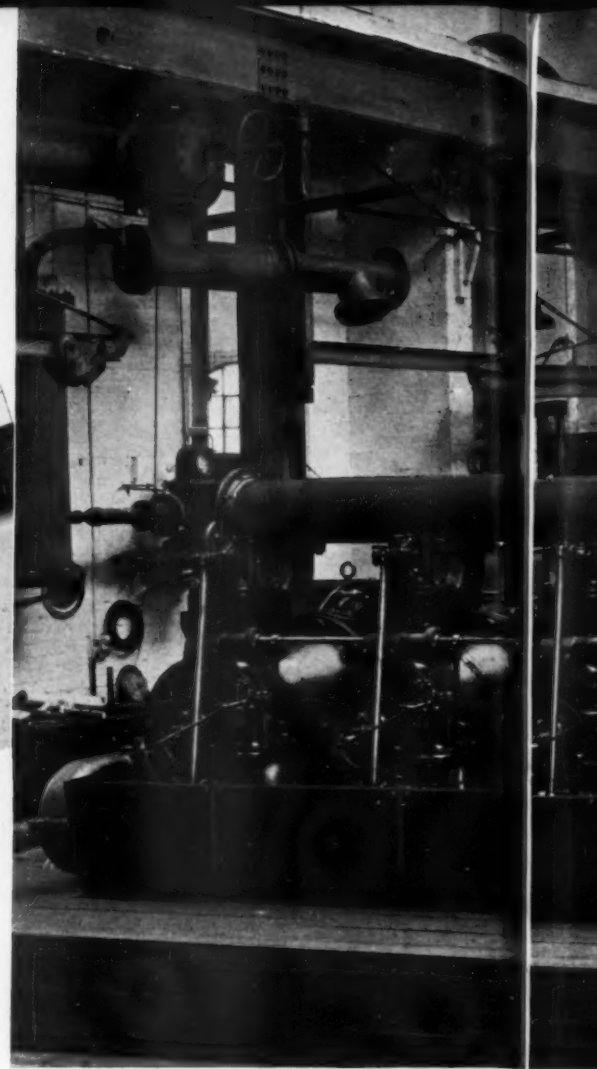


General views of handling and transportation of these enormous steel and concrete pipe segments. Diesels reduce this cost to \$0.0069 per ton miles.





570 hp. Harland and Wolff Diesel operating British Broadcasting Corporation's transmitter at Belfast. Largest Crossley Premier unit built to date, 2,200 hp., 12-cylinder engine installed at the African Manganese Co., Ltd., mines.



LONDON LETTER NO. 7

By GEORGE LIND

IN this country nearly all the principal Electricity Corporations use coal power for generation purposes and, despite an elaborate communal distribution system known as the Grid, it is still quite easy for Diesel power to undercut the Utility Company's rates. On the Continent, however, things are less favorable for the Diesel, and in countries such as Switzerland and Germany, provided with vast supplies of cheap, easily tapped water power, even the most efficient oil engines find it hard to compete.

As is only to be expected, a very large amount of Great Britain's trade in stationary generating sets is carried on with the Colonies and it is, therefore, appropriate to open this report with a description of two large units recently ordered by customers overseas. The first of these, the 3,250 bhp. English Electric-Fullagar unit for the Bermuda Electric Light, Power and

Traction Co., Ltd., has already received brief mention in these columns, and it is now possible to give more precise details.

In the Bermuda power station there are now four Fullagar type engines of 2,290 bhp., 1,440 bhp., 1,250 bhp. and 1,080 bhp., respectively, installed at various times since July, 1924. There is, in addition, a 200 bhp. Willans four-stroke unit, the total capacity of the station being 5,885 kva. The new eight-cylinder engine is to be coupled to an English Electric alternator of 2,080 kw., and differs from the older machines only in the use of airless injection.

The Fullagar two-stroke type of engine is particularly interesting in that it works on an entirely different principle from any other class of stationary Diesel. The cylinders are arranged in pairs, each bore containing two pistons. Diagonal rods couple the upper and lower pistons of adjacent cylinders, and as these

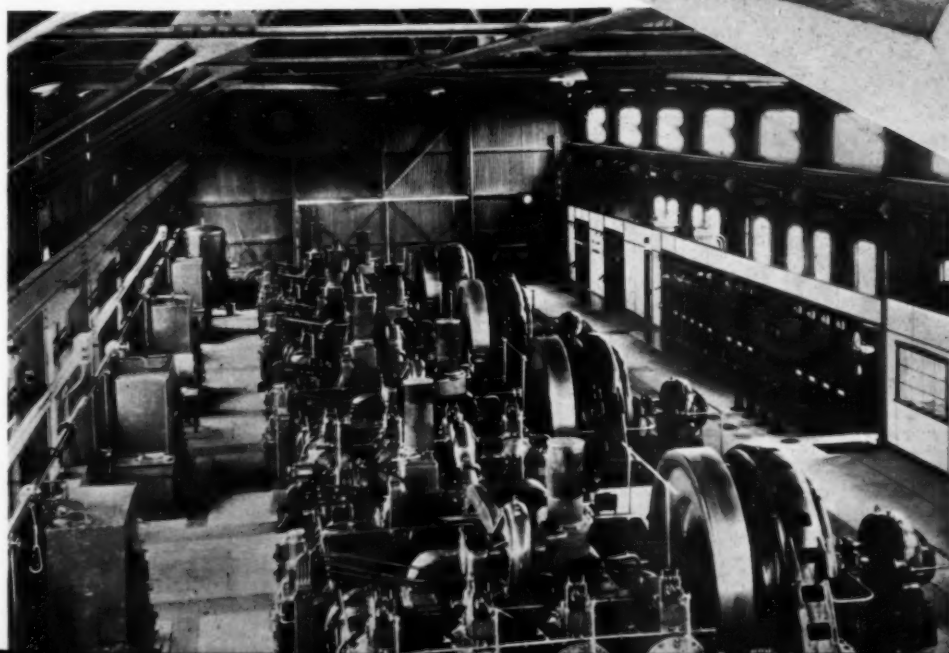
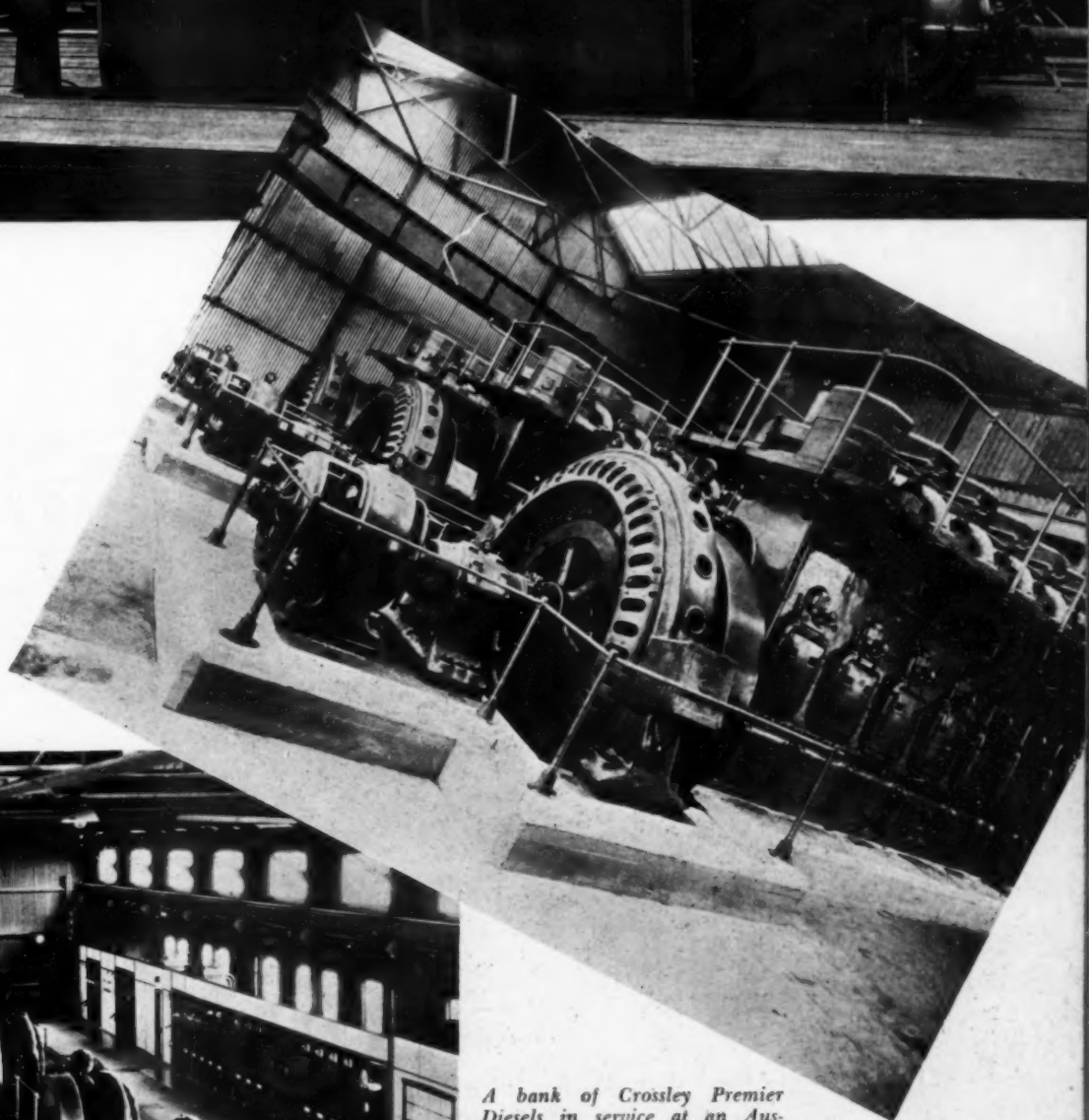
rods are external, only one crank is needed for each cylinder. Air in the cylinder is compressed as the pistons move towards one another, and after combustion the exhaust gases are discharged through ports uncovered by the pistons as they move downwards. Shortly after the opening of the exhaust ports a further set of scavenge ports is uncovered at the top of the bore, thus allowing a blast of scavenging air to pass right through the cylinder, with consequent good combustion and low fuel consumption.

The second installation, although not quite so large as the Bermuda set, is, nevertheless, quite as interesting. It has been built by the Crossley-Premier Company of Nottingham for the African Manganese Co., Ltd., and comprises two six-cylinder poppet valve, four-stroke, solid injection units of the well-known Crossley-Premier vis-a-vis type, with flywheel



alternator placed between the units and the exciter drive taken from an extension of the crankshaft. The cylinders have a bore of $8\frac{1}{2}$ ins. with a stroke of 28 ins. and are designed to develop 1,800 bhp. at 214 rpm. In this particular set, however, supercharging is being used, the net output reaching 2,200 bhp. at 214 rpm.

The alternator was supplied by Bruce Peebles and Co., Ltd., of Edinburgh, and has an output of 1,460 kw. It is of the open revolving field salient pole type and delivers three phase 50 cycle current at a pressure of 525 volts. The two blowers are electrically driven and at



A bank of Crossley Premier Diesels in service at an Australian gold mine. Above — Three vertical, 7-cylinder, 784 hp. Diesels also in mining service in the north of England and manufactured by National Gas & Oil Engine Co., Ltd.

2,900 rpm. can supply 2,900 cubic feet of free air at a pressure of 1.75 lbs. per square inch.

As regards the general construction of the engine, the leading characteristic is simplicity. The combustion chamber with its attendant injector is as near symmetrical in shape as possible and quite free from pockets, and the clearance volume, when the piston is at bottom dead center, offers the minimum surface area to the cooling action of the jacket water, thus assuring a good thermal efficiency. As opposed to normal design, the cylinders and breech-ends are cast integral, the object being to dispense with liner joints. Mild steel connecting rods and cast iron four-ringed pistons are used, the latter being slotted along one side of the skirt. By adjusting the width of this slot the skirt can be slightly sprung open. The valve gear is extremely compact, the inlet valve being placed vertically above the exhaust and operated by a push-rod from the camshaft. Only one cam is used for both valves, the exhaust being actuated by a rocker-arm. The fuel consumption of the engine is .37 lb. per bhp. hour.

Another unit recently supplied for use outside England is that for the British Broadcasting Corporation's new station at Belfast. This machine develops 570 bhp. at 330 rpm. and was built by Harland and Wolff, Ltd. It is a four-stroke trunk type airless injection engine of very neat design, and is connected to an

English Electric alternator of 395 kw., delivering three phase current at 400 to 430 volts.

In this installation the engine jacket water is cooled by means of a Premier open-type cooler and the water is circulated by hot and cold motor driven centrifugal pumps. Two fuel tanks of 40 tons each, arranged some distance from the power house, are supplied and fuel is drawn from these through an electrically driven transfer pump to the 450 gallon fuel settling tank in the engine house. From this tank the fuel gravitates to the centrifugal purifier, from which it is delivered to the 450 gallon clean oil tank and thence to a 125 gallon service tank in the engine room.

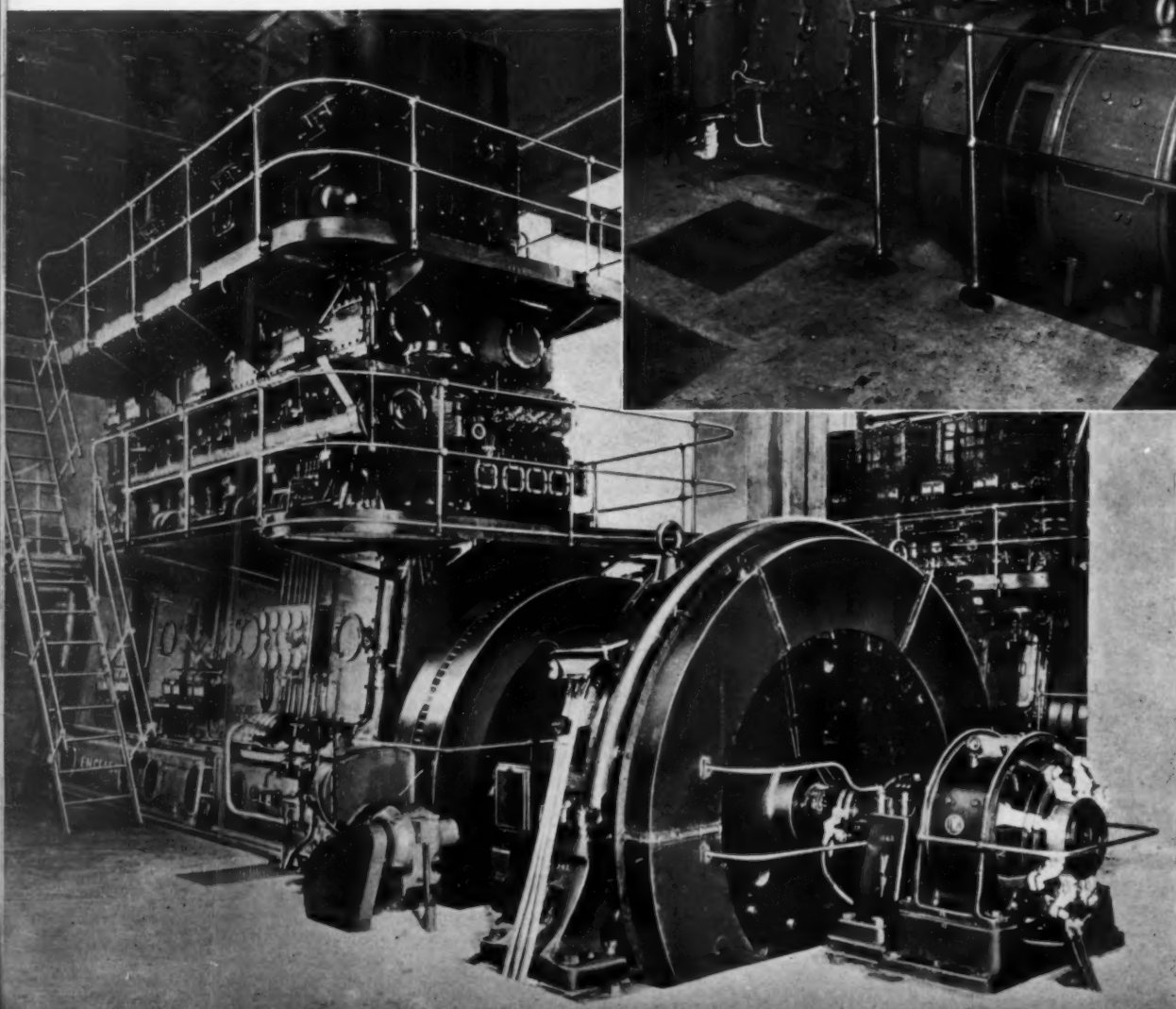
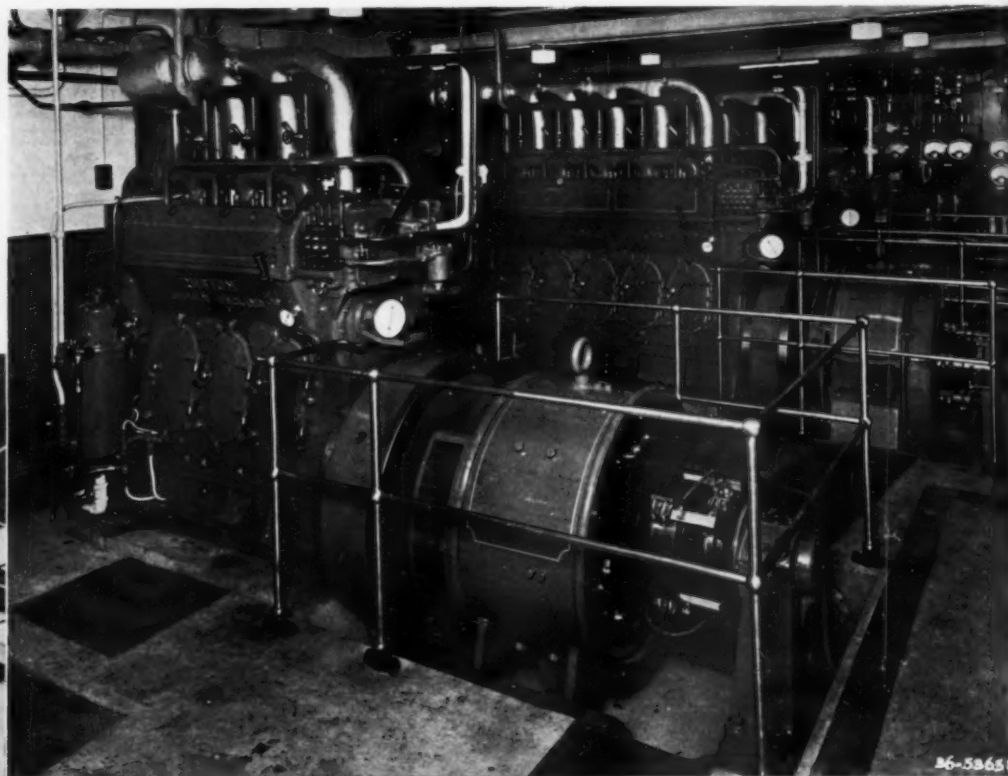
Starting is effected by compressed air at a pressure of 360 lbs. per sq. in., stored in a reservoir charged by means of a motor-driven compressor. The engine exhaust is led away over-

head outside the building and downwards into a silencer, from which it is finally led to the atmosphere by a vertical pipe a few feet higher than the roof.

It is noteworthy that this plant is intended as a stand-by, the normal load being taken from the Grid. Actually, on test, it has been found that the Diesel engine can supply all the station's requirements for very much less than that paid for Grid current.

In the coal mining and steel manufacturing districts of England, where solid fuel can be bought at rock bottom prices, one does not expect to find many large Diesel generating sets at work. Nevertheless, a number of such units are in use in these areas, some at the very pit heads themselves—a striking testimony to the engine's efficiency.

. . . . And now please turn to page 46



Heal and Sons' plant in which are installed three Ruston Hornsby engines. Left—One of the English Fullagar Diesels at the Hamilton, Bermuda, central power station. A new solid injection, 3,275 hp. engine of the same make is being added which will bring the total power of the station up to almost 10,000 hp.

DIESELS IN SHOVELS, TRUCKS AND ROAD ROLLERS



Bay City Combination Shovel and Crane (1¼ yard bucket — 20 ton crane) in which the Hercules six-cylinder 5 x 6" Diesel engine is installed. This unit, and other Bay City Hercules Diesel equipped machines, are in service in Los Angeles County by the United States Engineers Department; see article in DIESEL PROGRESS, pages 22-23-24, April issue.

This is a Federal Model 25 in which Hercules six-cylinder Diesel engines are used. The Model 25 chassis has a nominal rating of 2½-3½ tons with total allowable weight of 14,500 lbs. when supplied as a truck chassis. This same Model 25 is also available in a tractor type, the capacity of which as a hauling unit is determined by the type of trailer to be used.

Galion "Warrior" Rollers — made by the Galion Iron Works and Manufacturing Company, Galion, Ohio. The rollers shown are eight-ton and are equipped with Hercules six-cylinder, 3½ x 4½" Diesel engine. The same size Diesel engine is used also in the 5, 6 and 7 ton Warriors. The two rollers pictured here are in service in Puerto Rico.

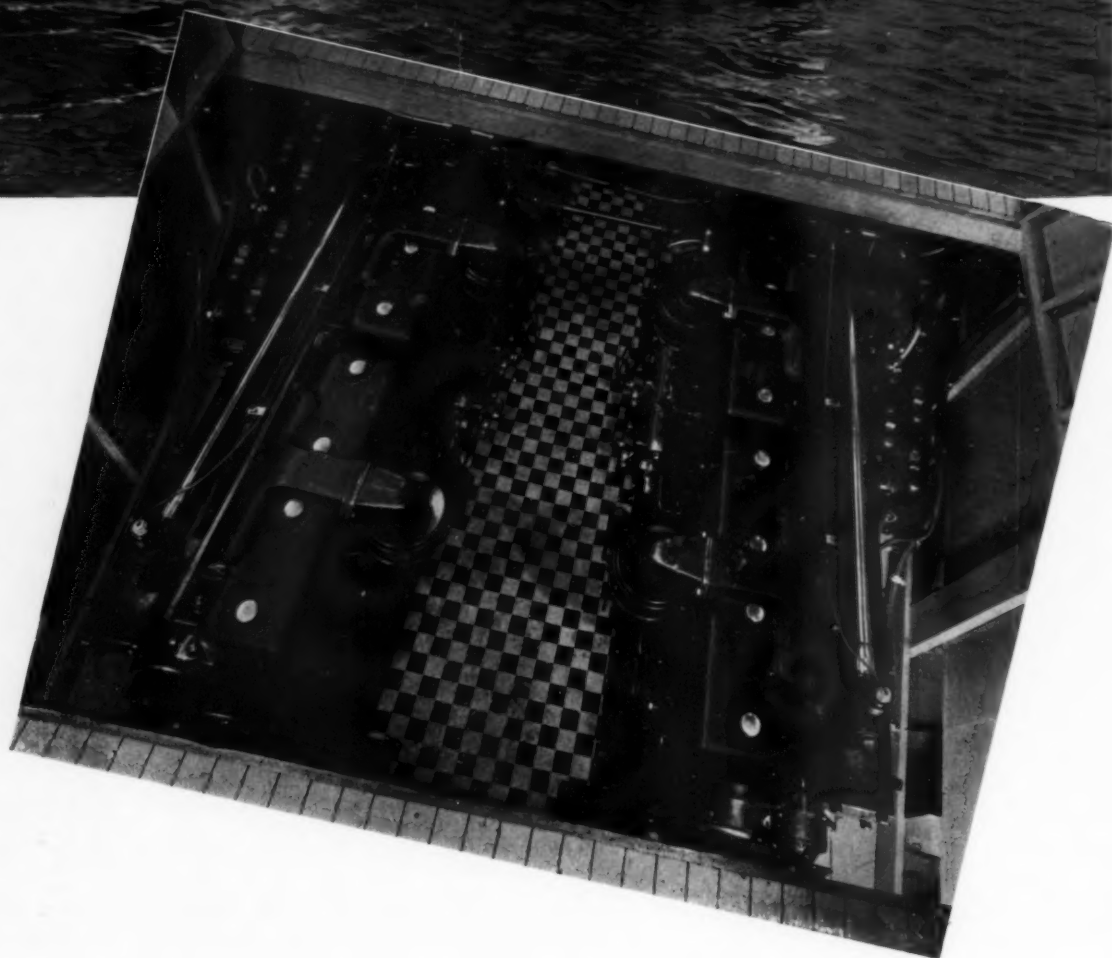




"Karina" on one of her trial runs. Inset — The two 150 hp. Superior Diesels which give her a cruising speed of 18 mph.

KARINA

New Dawn Fifty Foot Cruiser

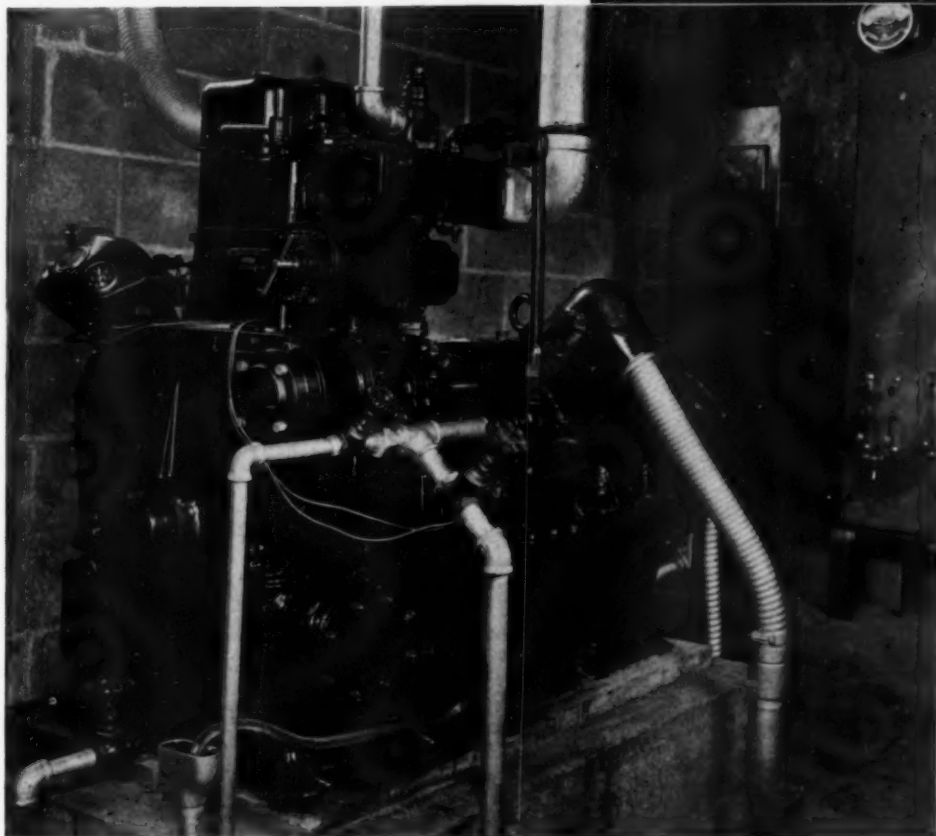


IN the latter part of the nineteenth century Mr. Robert E. Tod, then Vice-Commodore of the Atlantic Yacht Club, entered his schooner *Karina* and with her won a 130-mile race from Montauk Point to Sea Gate. At this time the event was regarded as rather hazardous, but did revive interest in ocean racing, which culminated in the famous race for the Kaiser's Cup in 1905. In this trans-Atlantic contest, won by the since famous schooner *Atlantic*,

Mr. Tod entered the schooner *Thistle* and had the distinction of being the only one of eleven owners who was also his own captain and navigator. During the ensuing years he has owned and sailed a great number and variety of yachts so that his selection of Diesels for his new Dawn cruiser is the result of ample and mature judgment regarding the problem of marine power. The engines installed in *Karina* are a pair of 150 hp., eight-cylinder Superior Diesels

directly connected to the propellers which they drive at cruising speed of eighteen miles per hour, at about 1,600 rpm. With a fuel tank capacity of four hundred gallons, the cruising range is approximately 850 miles or roughly double that of a similar boat gasoline powered. When one considers that, in addition, the price of fuel oil is only one-quarter that of gasoline, the economy of operation of *Karina* is obvious.

Where the Superior Diesel (below) furnishes power in the form of heat to hatch 200,000 baby chicks per year.



INCUBATOR DIESEL

BECKER'S Standard Hatchery, located at Vineland, New Jersey, hatches approximately 200,000 chicks a year, using a two unit Bundy Incubator and Hatchery of 28,000 egg capacity each and a Smith Incubator holding 47,000 eggs.

The incubators are heated by electrical resistance placed inside and it is necessary to maintain a temperature of 100 deg. F. with an allowable variation of only $\frac{1}{2}$ deg. F. This close regulation is obtained by special thermostats which Mr. Becker helped develop.

Success in hatching chicks depends greatly upon the maintenance of a constant temperature. Therefore, a failure in electric power will result in great loss.

To be assured of constant electric service, Mr.

Becker installed a Superior Diesel Engine and 15 kw. direct connected generator on December 18, 1935. This plant has been in operation twenty-four hours a day since that date, with the exception of one day each week for inspection.

The close temperature regulation results in constant cutting in and out of the incubator heaters, giving a generator load fluctuation of as much as 40 per cent. The quick action of the engine governor handles this unusual condition in a highly satisfactory manner.

In addition to the heating requirements of the incubator the engine generating set furnishes lighting service for the hatchery, Mr. Becker's home and other buildings. During the past winter the engine jacket water was circulated through radiators equipped with small motor

driven fans and in this manner sufficient heat was recovered to maintain the desired temperature in the hatchery.

On the basis of the power produced by this plant under present operating conditions, Mr. Becker advises that it would cost over \$200 per month for purchased electric power. The operating cost of the Diesel unit has not exceeded \$45.00 per month for fuel, lubricating oil and maintenance.

The Superior Diesel engine is of $4\frac{1}{2}$ inch bore, $5\frac{3}{4}$ inch stroke, two cylinder, 4 cycle, operating at 1,200 rpm. The rating for continuous load at this speed is 20 hp. with a permissible intermittent load of 25 hp. The generator is of Westinghouse manufacture and has direct connected exciter.



PRINTING WITH DIESELS

By E. SCHOONMAKER

THE Freybourg Printing Company, Mount Vernon, N. Y., prints everything, including the local weekly. It is an old established concern which paid the Power Company about \$1,000,000.00 through the years 1913 to 1934. The shop force of 24 men and women operate 11 presses, 10 type casting machines, 2 cutters, 4 folders and various binding machines. This equipment requires about 60 hp. in electric motors, which are used intermittently or all at one time, as the occasion demands, the presses, of course, being in use most of the time. A study of this load proved it to be of the fluctuating type, caused primarily by jogging of presses, which created line surges that had to

be compensated for in order to provide constant voltage regulation.

The installation consists of two 40 hp. Fairbanks-Morse Diesel engines direct connected to oversize 40 kva. alternators. The plant is located in basement space hardly 8 feet square, which formerly stored coal for the present heating boilers. Boilers are now oil fired and use the same fuel as the Diesel engines.

The switchboard panels, one for each engine, are fitted with volt, ampere and kilowatt meters to indicate the load on engines at all times. An automatic voltage regulator control is also mounted on the switchboard to serve both gen-

erators, and in conjunction with the oversized alternators, it takes care of the line surges without extreme voltage fluctuation when the presses are being "jogged."

The operation of this Diesel plant began November 1, 1934. Its schedule of operation keeps the engine running 55 hours weekly. Fuel and lubricating costs for the load, which varies between 24 and 45 kws., averages 24 cents an hour for both engines. Except for the initial supply, cooling water does not figure into the cost of operation. A Fairbanks-Morse pump and motor combination circulates the water through a radiator located on the second floor. During the winter months, heat is taken



from the water by radiation, keeping the storage space warm. The installation of Maxim exhaust silencers to meet the particular requirements of this locality is so satisfactory that no complaint has been registered from outside sources as to the operation of the Diesel engines.

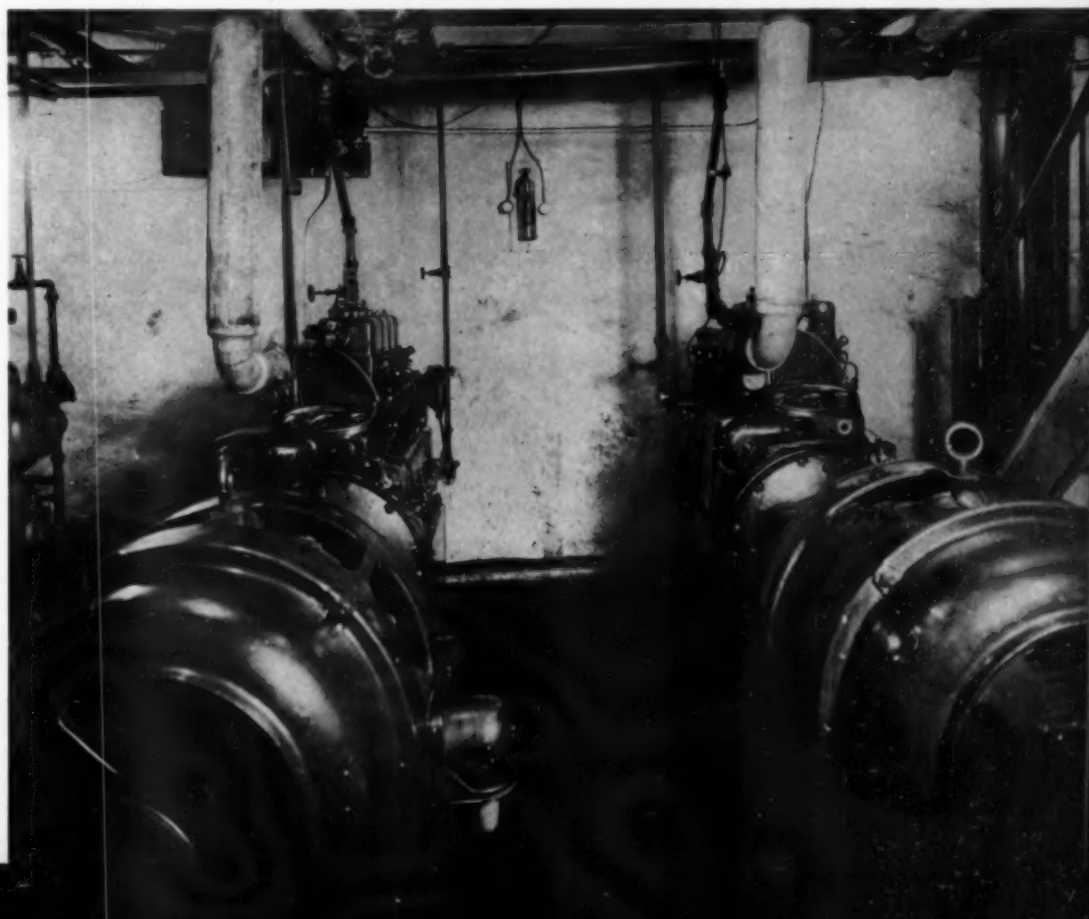
Equally surprising is the small amount of care and attention the Diesel plant requires. In this case, as with many others, the handy man, who also drives Freybourg's delivery wagon about the city, looks after the engines now and then throughout the day. Their operation being automatic, his duties consist of starting the engines with push button control, and stopping them by cutting off the fuel. Except for inspecting the lubricant system and cleaning the filters occasionally, there is little else involved. As a safeguard against high engine temperatures due to a lack of oil or cooling water, an automatic alarm system was installed, which to date has not been set off. As these engines create power by igniting fuel oil solely from the heat of compression, there are no spark plugs and consequently no complicated ignition system to care for. The governors on these engines react to the load automatically and thereby increase or decrease the fuel as needed. In case of a light load, additional savings in plant operation are available by running but one engine and, as the load requires, it takes but a minute to start up and

parallel the operation of the second unit with the first engine.

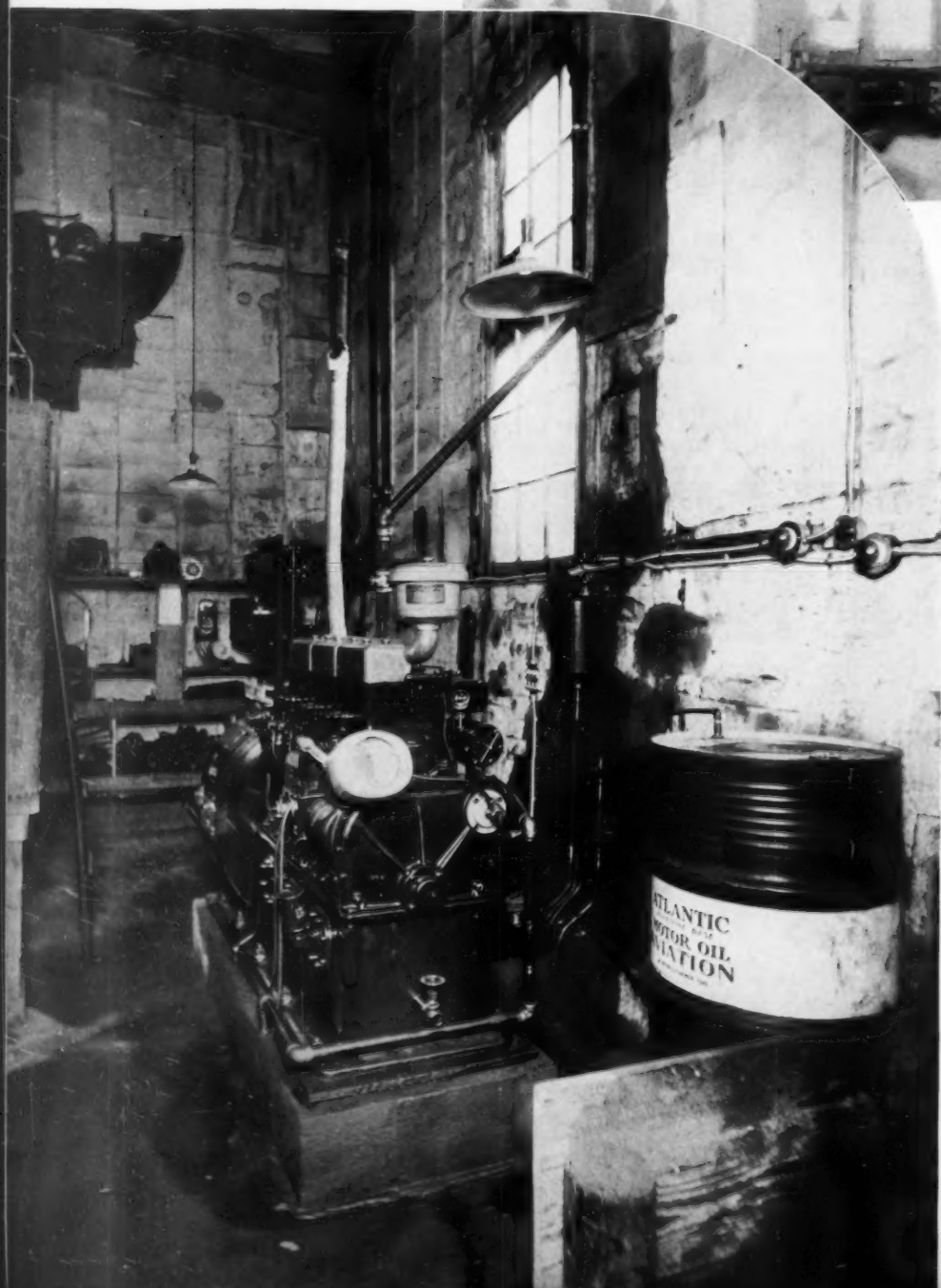
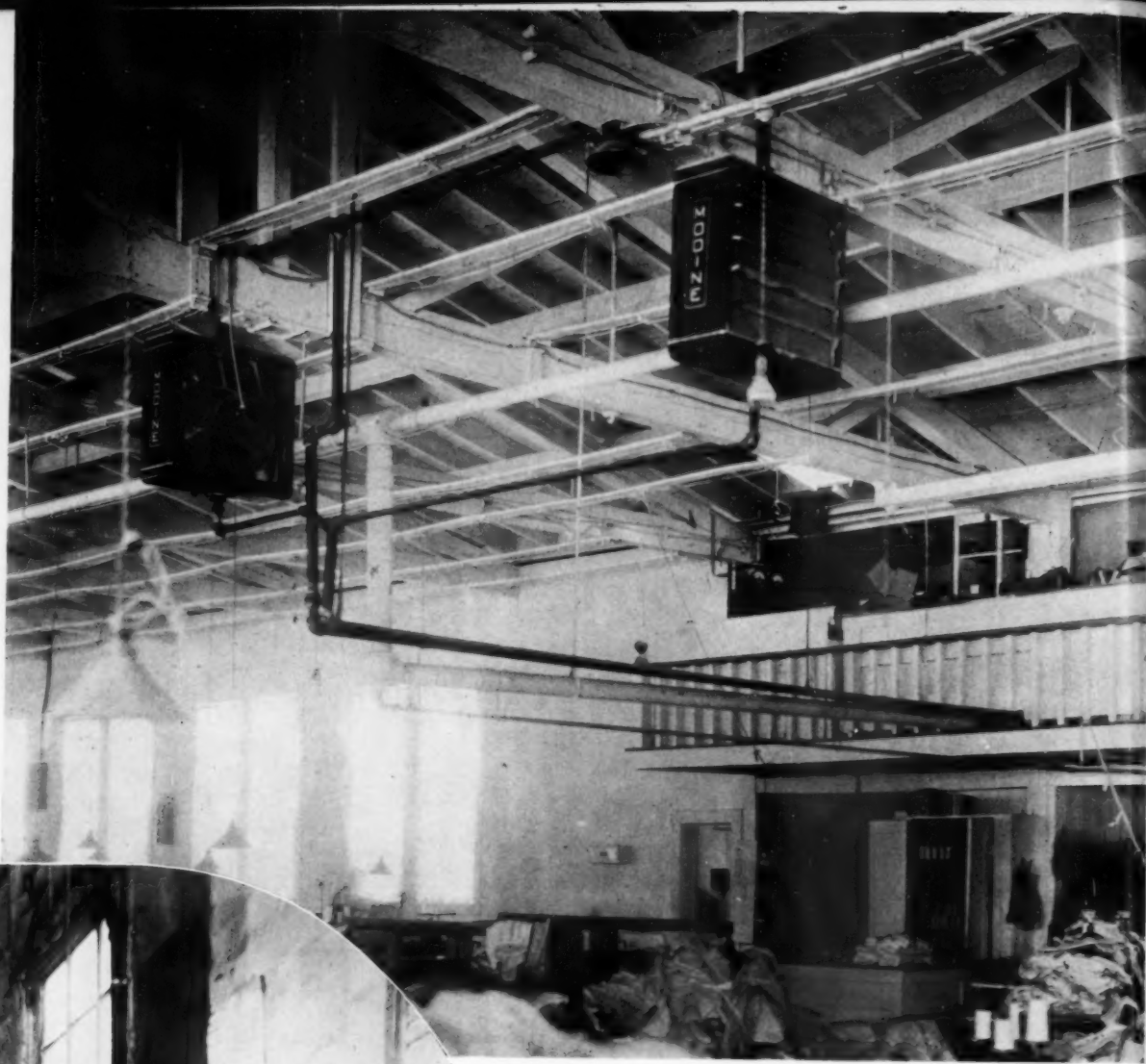
The Freybourg power problem is no different than a good many others. They were paying a high rate and, as each protest was filed against this higher power cost, their demand charge was increased 25 per cent to 50 per cent. Not getting any relief through the lean years (1930-1934) they decided to use Diesels for power.

The penalty charges and high rates formerly charged by the Power Company on account of a low load factor have been eliminated. They now depend on Diesel generating equipment for their power requirements and, in spite of a fluctuating load and low power factor, Freybourg reports that their average cost for fuel and lubricating oil as being considerably under 1¢ per kwh.

The basement power house where two 40 hp. Diesels furnish power for the pressroom above.



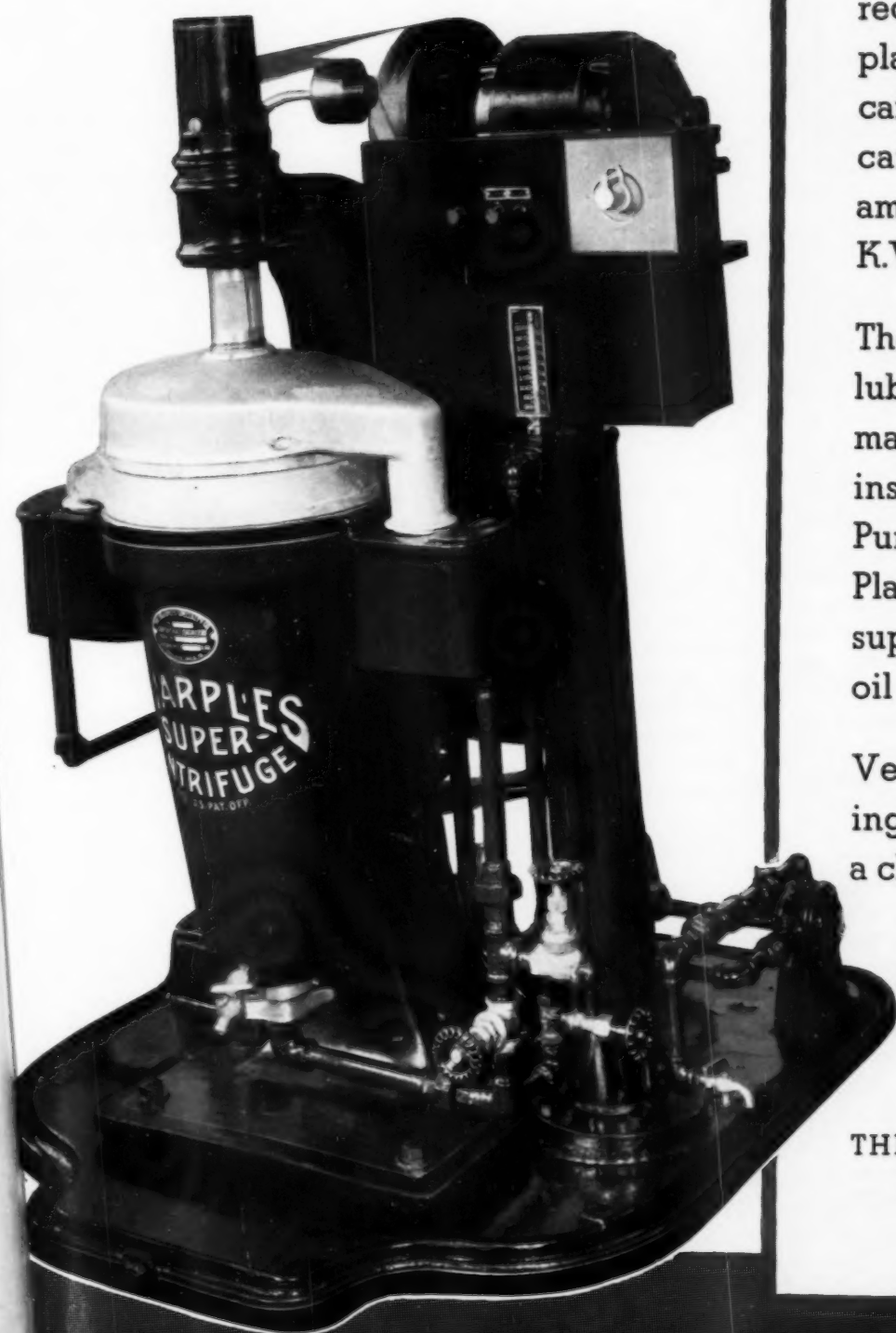
SHIRTS A LA DIESEL



AS has been repeatedly pointed out by DIESEL PROGRESS, the uses and applications of the Diesel engine are legion. In further support of this contention comes news from Lopez Pa., that the shirt factory of Smith, Levine and Harris depends entirely upon a Diesel for power, heat and lighting. This thriving business has an electric power load of slightly less than 4000 kwh. per month divided between a considerable amount of lighting and a large number of small motors on sewing machines. Up to last winter this power was purchased from the local utility but the facts and figures on Diesel economy were not to be denied and the plant was converted.

Mr. E. F. Waldeisen, Electrical Contractor of Williamsport, Pa., made the installation of a 4½-inch bore, 5¾-inch stroke, Superior Diesel directly connected to a 40 kw., three-phase, 60-cycle, 240-volt Westinghouse generator. The unit operates at 1200 rpm. and was placed in one corner of the old heating boiler room. A careful check over one month of Diesel operation from February 8th to March 8th showed a total of 3660 kwh. developed in 233½ hours of actual running time. The cost of fuel and And now please turn to page 51

INVESTMENT IN SHARPLES CENTRIFUGAL PROTECTION IS PROFITABLE!



AN IMPARTIAL survey of Diesel Engine Plants recently made proved that the plants using centrifugal purification of fuel and Diesel lubricating oil were consistently among the lowest in cost per K.W. connected load.

The profitable way to keep both lubricating oil costs and engine maintenance costs down is to install the Sharples En Bloc Oil Purifiers in your Diesel Engine Plant and then use an ample supply of purified high quality oil on your engines.

Very substantial fuel cost savings can also be made by using a cheaper, heavier grade of fuel oil, Sharples clarified for the greatest possible protection of your engine investment.

▼ ▼ ▼

THE SHARPLES SPECIALTY CO.
2304 WESTMORELAND STREET
PHILA., PA.

SHARPLES *Centrifugal Engineers*

DIESELS IN AGRICULTURE

Continued from page 26

spraying, hedge pulling, farm road grading, feed grinding, pumping and generating power for lights. The Diesel has already won great popularity among fruit growers. The Ontelaunee Orchards, Inc., of Leesport, Pa., own several Diesels and these are kept busy operating power take-off sprayers and disk plows. William Schiefeistein stated that the tractors are used on night shifts for spraying purposes. It formerly required six days to cover the orchard, but the same work was now completed in four days, he said. The fact that the Diesel could be used night and day has proved of great value because the obstacle of wind was not present at night. On several occasions the tractors were operated for practically 72 hours at a stretch, with only time out to change oil and refill the sprayers.

"These tractors have pulled twice the equipment possible with the gas tractors, previously owned," Mr. Schiefeistein said. As to economy the Diesel tractor pulling and powering a sprayer consumes only slightly more than one gallon of low cost fuel oil per hour. Pulling a disk the tractor burns less than 2 gallons per hour.

"In other words, we can operate these tractors for little more than the cost of the gas tax, which in Pennsylvania amounts to 4¢ per gallon, Federal tax included. Our fuel oil costs us 6¢ a gallon delivered."

It is common knowledge in the middle west that a good job of plowing is worth \$1.00 an acre and actually costs the farmer that amount if he uses horses or the type of power that has been used for the past 15 years. Many types of soil and especially heavy plowing in the fall costs \$1.25 to \$1.50 per acre and many times it would have been worth more than \$1.50 per acre to get the plowing done on time in the spring, when wet weather has held up farm operations. At this time there are a large number of contract farmers throughout Illinois, Indiana, Minnesota, Wisconsin and Michigan who are able to make a reasonable profit for themselves by plowing for their neighbors with their Diesel track-type tractors. At the same time they are able to plow this land on time because of having a large plowing unit, and are able to plow the land at a figure that is so low that it becomes more economical for many farmers to hire them rather than to try to do their work with their own power.

Many owners of 160 acre farms satisfactorily handle all of their planting, cultivating and

harvesting, including the haying work, with two or three horses. This same number of horses could not plow the 70 to 100 acres that might need to be plowed in the spring on time. For \$80 to \$100 these farmers can hire a Diesel contract farmer to come in and plow this work on time, relieving their horses from the heavy work so they will be in good condition for the planting and cultivating.

An outstanding example of successful Diesel contract farmers is the five Unz brothers at Reddick, Illinois, who have been doing this type of work with track-type tractors for nearly 8 years. They now have more work than they can do, although they have four tractors in the family. One of these machines has operated more than 12,000 hours. One of them shelled over 1,000,000 bushels of corn. One of their large Diesel track-type tractors pulled seven 14-inch plows, turning two to two and a half acres per hour on from two to two and a quarter gallons of 6¢ fuel per hour. The Unz Brothers' fuel costs have run less than 15¢ per hour, which means about 7¢ per acre for fuel on plowing work.

A combination of track-type tractor that permits use of the large size of tractor without packing the soil and with perfect ease in getting over loose seedbeds in the spring or wet harvest in the fall, together with the economy of the now proven Diesel engine, provides an outstanding improvement and worthwhile cut in the cost of operations for the Cornbelt farmer.

In Minnesota, where the Morris Florence farms, formerly the famous Jim Hill farm, are operating five Diesel tractors, they have had time to prove the overall efficiency of these machines. More than 10,000 hours of operation have already been produced at an average fuel consumption of less than 2 gallons fuel per hour plowing over 2 acres per hour and none of these tractors have had any major repairs.

The west coast, with its highly diversified agriculture and its wide variations in soil and surface conditions, has proven to be an ideal field for the Diesel tractor. Last year alone 30,000 drawbar Diesel horsepower was sold to west Coast farmers of the United States by one manufacturer. A representative owner is J. E. O'Neill of Fresno, Calif. Mr. O'Neill purchased one of the first 35 hp. Diesel models to be produced and not long afterwards purchased two more of the same power. It had been the owner's belief that a tractor's usefulness was ended at 10,000 hours operation. This belief being based upon his experience with gasoline powered tractors. However, to quote

Mr. O'Neill, "When our first Diesel had completed over 12,000 hours running, I was naturally inclined to trade the machine for a new one." When the tractor was overhauled it was found that the final drive pinions, bearings and gears, together with all interior driving mechanism, were all nearly as good as new. The original tracks lasted throughout the 12,000 hours by turning the original pins and bushings. The tractor, the owner states, is still in excellent operating condition. Under full load the machine operated on two gallons of Diesel fuel per hour. No crank case oil was added between drainings. The load usually pulled was 100 inches of disk plow at an average of 8 inches deep.

Similar to this is the experience of Hamm and Johnston, Fresno, Calif., who also own an early model Diesel tractor. This unit has worked 1,400 hours at a total repair expense of only \$83.00. Some of its jobs have been plowing, pulling disk harrows, cultivating, digging beets, pulling combines in rice, beans and grain. Fuel savings, the owner stated, during 28 months of operation, have piled up a total of \$4,628.00. Under an average load the tractor burns just under 2 gallons fuel per hour, while during a harvest, pulling a large model combine threshing wheat, only 8½ to 9 gallons are used per 10-hour day. An added job for the tractor is the powering of a rain machine. It has worked about 750 hours on this task, pulling a 4-inch pump 24 hours a day and consuming only 1¼ gallons fuel oil per hour.

The advent of the Diesel tractor was the first practical solution of soil erosion by wind and water. This machine has been used in many ways to battle the soil thief, pulling terracers to build permanent broadbase terraces on the contours, and in some of the larger field areas elevating graders. Its inherent fuel economy has enabled counties to purchase fleets of these Diesels for the terracing of private lands within the boundaries of their counties on a per-acre rental basis, which has been of nominal cost to the farm owner. This low cost was possible only through the Diesel's low consumption of a low-cost fuel oil and its ability to lug and work in small and hilly fields. Terracing units are now in wide use through the badly eroded regions of the south, southeast and the great plains areas.

In addition to this direct reclamation work, the Diesel tractor has followed through on the restoration of the soil after terraces were built. It has been valuable and economical in turning under-cover crops to restore land fertility.

When **UNCLE SAM** Uses **HESSELMANS** you *know* they are good engines



When Uncle Sam starts moving dirt he wants plenty of speed and power in the shovels and draglines he uses. In the Federal flood control operations in the Los Angeles area there are in government service Lima, P&H, Bay City, and American draglines and shovels, 2½ to 1 yard in size . . . eleven of them in all . . . and almost as many more being used by private contractors —and every one of them is powered with a *Waukesha-Hesselman Oil Engine*. Engine sizes range from the big 190 hp. six cylinder Hesselman to the 75 hp. four cylinder Hesselman.



To burn "modern high speed diesel fuels" you do not need to use hard-starting compression ignition engines. The Hesselman Engine is a low compression, solid injection engine that burns these fuels with high efficiency; yet weighs no more than, and starts as easily as, a gasoline engine. Electric spark ignition gives these advantages —easy starting, smooth-running, high economy. The Hesselman is also moderate in first cost. Write for Bulletin 1000. *Waukesha Motor Company, Waukesha, Wisconsin.*

WAUKESHA ENGINES

LONDON LETTER

Continued from page 36

Typical of such installations is that at the Coal and Allied Industries' workings at Seaham Harbor, County Durham. The engines employed there are vertical four-stroke direct injection Nationals of 784 bhp. coupled to 522 kw. At the moment, owing to a serious fire in one of the neighboring factories, only one engine, running on light load, is being used, but when the plant is working to full capacity some exceptionally low fuel consumption figures (.37 lb. per bhp. hour) are promised by the makers.

Leaving the coal mines and coming farther south again, some recent additions to the Falmouth Docks and Engineering Company's plant and the new installation at Messrs. Heal & Sons' furniture store in London also deserve mention here.

At the Falmouth station there are now seven Diesels, developing a total of 2,065 bhp., in addition to two 730 bhp. Allen Steam turbo-generators. The interesting point about the engines is the fact that they are all two strokes.

The most recent additions are British Polar units, one a five-cylinder of 875 bhp. and the other a four-cylinder of 260 bhp., employing direct injection and pump scavenging. They are both neat, workmanlike jobs equipped with injection gear of Polar make, double-acting water pumps, gear-type lubricating oil pumps and scavenge air blowers, and are mounted on heavy concrete beds having insulating mats of Absorbit compressed cork. In general, the four-stroke cycle is preferred in this country for power station work, but, according to the Falmouth Dock Company's reports, these Polar units are equal, if not superior, to any four-stroke machine, both as regards reliability and efficiency.

The story of Messrs. Heal & Sons' new installation is best told in the words of the company's official report. Here it is:

"A considerable amount of investigation was done by Mr. G. S. Beale (secretary to Heal & Sons) and Mr. S. M. Barlow (managing director of Barlow and Young, electrical engineers) before the decision was taken by Heal's to install their own generating plant. The present

loads were analyzed and the circuits rearranged to take every advantage of the most favorable rates offered by the supply company for shop window lighting and flood lighting, etc. Alternative tariffs were also fully investigated, but the investigators were not able to obtain from the supply company rates which would effect any very great saving in the electricity bill. They, therefore, turned their attention to alternative forms of supply, eventually deciding that the Diesel engine promised to be the most suitable. The following factors influenced their decision to recommend the Board to install their own generating plant:

1. The steady increase over a period of years in the consumption of electricity in the company's factories, on the premises and, more particularly, in the lighting of the shop.
2. The installation of two additional passenger lifts in 1933 and the prospect of a third additional lift in the near future.
3. The extension of the circular staircase and the provision of its special Archi-

FIRST..the GRAF ZEPPELIN...NOW..the HINDENBURG

THROUGHOUT its impressive career the Graf Zeppelin has depended on Bosch Magnetos and Bosch Spark Plugs. And they never failed • Now the new Hindenburg depends on Bosch fuel injection equipment for its Diesel Engines • Equipment of the same proven design and construction is built in Springfield, Mass. by the United American Bosch Corporation, pioneers in the development of Diesel injection equipment in America.

UNITED AMERICAN BOSCH CORPORATION
SPRINGFIELD, MASS. New York Chicago Detroit

tectural Soffit lighting which consumes a good deal of current.

4. The rebuilding of K. block (Warehouses and Workshops) and the imminent rebuilding of D. and G. blocks (Showrooms and Shop Windows).
5. The very marked tendency for the intensity of illumination in showrooms and shop windows to increase, and the development of flood lighting.
6. The amazing increase in the electricity bill and the inability of the supply company to provide rates which would fit in with Heal's particular needs. The peak load is an extraordinarily heavy one, but it lasts for only a few hours per day.

A scheme was then prepared by Messrs. Barlow and Young in conjunction with Messrs. Ruston and Hornsby, which, on the basis of the present consumption, promised a marked saving in the cost of electricity. A very conservative estimate was submitted, taking into account not only the cost of fuel, lubricating oil, mainte-

nance and repairs, etc., but full allowance was also made for depreciation, interest on capital and additional rates. The comparative saving will, naturally, become greater with the inevitable increase in the amount of current consumed. The scheme and the calculations were submitted to a firm of consulting engineers, who found them correct. Heal's, therefore, decided to go ahead with the installation of the plant."

The site of the power station is a part of the shop basement directly below the showrooms and offices, special precautions having been made to prevent the transmission of noise or vibration to other sections of the building or to adjacent property. The chief items located here are four generating sets with a combined capacity of 257 kw., space being allowed for a fifth set of 140 bhp. capable of raising the output to 352 kw. The Ruston Hornsby engines are of three different sizes, in order to obtain a greatest economy at all periods of the fluctuating load, the two largest developing 140 bhp. at 560 rpm. and the others 84 and 17 bhp., respectively. The three main engines

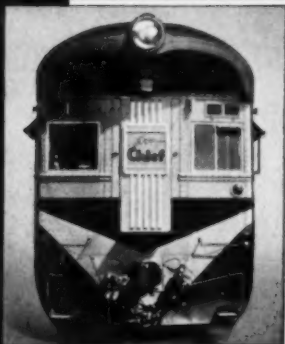
are five and three cylinder vertical four-stroke units of standard Ruston design, direct coupled to 220 to 440 volt generators. The smaller machine, which is used for night duty, is a single cylinder horizontal unit, driving a 10.5 kw. dynamo by means of Texropes.

In premises of this size, large supplies of hot water are always required for central heating and domestic services. For this purpose Heal's have installed three Clarkson exhaust gas boilers, two attached to the 140 bhp. engines and one to the 84 bhp. unit. At normal load the total heat reclamation figure is 195,000 British Thermal units per hour.

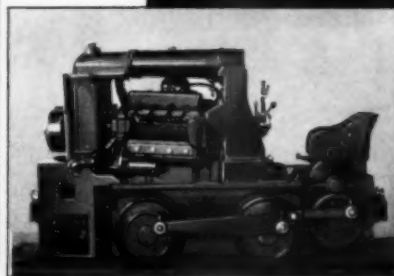
Taking into consideration the cost of fuel, lubricating oil, maintenance and repairs, depreciation, interest on capital and extras, the operating cost of Messrs. Heal & Sons' plant works out at 1.43d per unit. The rates which would have to be paid for external supply amount to 2.09d per unit, so that the Diesel installation has effected a saving of 32 per cent in the electricity bill—a thoroughly creditable performance for a plant of this size.



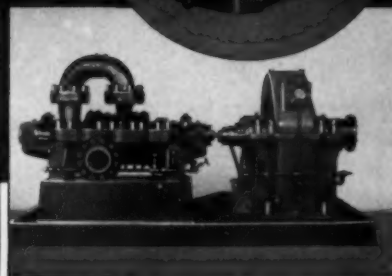
This yacht is equipped with two 500 h. p. Winton Diesels. Heat Exchanger cools jacket water.



Santa Fe "Super Chief". Equipped with four Winton 900 h. p. Diesels. Harrison Heat Exchangers used for cooling the jacket water.



Ruth mine locomotive powered with Buda Diesel engine which is equipped with Harrison Oil Cooler.



Gear speed unit manufactured by Farrell-Birmingham Co., equipped with Harrison Oil Cooler.

HARRISON HEAT EXCHANGERS

HARRISON RADIATOR CORPORATION
LOCKPORT, N. Y.

Gear driven blower 250 h.p.—10,000 r.p.m. Pumps lime kiln gas in beet sugar refinery. Heat Exchanger cools lubricating oil.



PIPE DREAMS AND DIESEL REALITIES

Continued from page 33

from the curing platform to the trailer with a winch line. After being securely blocked on the trailer it is then ready to embark on a 5 mile ride.

I was invited to experience the ease with which this gross load of 65 tons was handled by the big Sterling Diesel tractors. I have driven trucks with loads of 20 tons, but when I looked at this huge pipe, loaded and ready for me to drive 5 miles to its resting place, I felt exactly as a flea might before taking a ride on a roller skate. Imagine my surprise when I found that I could drive this tractor and its big load with ease over an improvised road, although I weigh only 110 pounds.

The thrill that driving this tractor, pulling the greatest load ever hauled over desert sand by a single unit, gave me is hard to describe. My first reaction was that this must be a very expensive hauling job, but when I inquired

about how much it costs to transport a 45 ton pipe 5 miles I was indeed surprised at the very low cost of this operation. One obliging statistician gave me the following figures, which he called "out of pocket" costs for a day of eight hours:

Driver's wages.....	\$6.00
Diesel fuel (35 gallons).....	1.31
Engine oil including changes.....	.75
Service, labor and grease.....	3.25
Insurance	1.25
Out of pocket cost per day.....	\$12.56

The tires are expected to finish the job without replacement. Each tractor hauls 8 pipes per day at a cost of \$1.57 each. The total mileage per day for each tractor is 80 miles. The cost per ton—\$0.0348; the cost per ton mile—\$0.0069. Mr. Howard Jenkins, vice-president and general manager of the American Concrete and Steel Pipe Company, stated that when this job was planned they had anticipated 8 pipes per day for each tractor to haul on the average

distance of 2½ miles (the manufacturing plant being 5 miles from each end of the project), but it has been shown that 8 pipes per day could be hauled 5 miles by each Diesel tractor unit.

This 220 million dollar project is a good demonstration of the efficiency of the modern Diesel engine. On this one job the contractors are operating, in addition to the two 50 ton Sterling Diesel tractors, one 20 ton Sterling Diesel tractor handling reinforcing steel from Torrance, California, a distance of 67 miles. The average running time for this steel unit is 27 mph., making two trips in 12 hours. During the 20 months required to complete this contract, Cummins Diesel power used in transporting 168,000 tons of reinforcing steel will effect a saving of \$4,800 in fuel alone.

In addition to the two Diesel trucks, there is a Lima 3 cu.yd. drag line powered with a Waukesha Diesel engine and one Caterpillar Diesel tractor used in excavation work.



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DIMENSIONS:
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Diesel or Gasoline, optional
Accommodations for two
in crew and from five to
eight in owner's party

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Twin Superior Diesels of 150 H.P. each afford economy in fuel consumption and wide cruising radius, and drive KARINA at a sustained speed of 18 miles.

Built over standardized moulds, the new DAWN "Fifty" offers all yachtsmen the advantages of "individualized" interiors for commuting or fishing, and the same elements of privacy, versatility and speed of the larger yacht, at but a fraction of the cost.

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are engineered to the Diesels they serve. In every major and minor detail they are designed to turn Diesel power into kilowatts dependably and smoothly. They insure a successful installation.

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PITTSBURGH, PA.
Electric Power Department
RIDGWAY, PA.

A NEW ARMY DIESEL TANK

THE United States Army is now asking funds to purchase 75 new light tanks as developed at the Rock Island arsenal. This fast machine is the first in this country to use Diesel power.

The fact that the new tank has a Diesel engine was not previously announced because release of information concerning new developments at Rock Island arsenal must come from the War Department at Washington. It was for this reason only that Colonel A. G. Gillespie, commandant of Rock Island arsenal, did not permit publication of details when the tank made its test run.

Comparison of available data shows that neither in size, power nor armament can the high speed tanks used by Italy's flying columns in Ethiopia measure up to the United States Army's latest land "destroyers" such as are being manufactured at Rock Island.

The tank was taken to Dallas for installation of the Diesel engine and, after tests there, started its overland journey to Rock Island on a "break in" run during which it averaged a little better than 33 miles an hour for the 1,076-mile trip in elapsed running time of 32 hours and a few minutes. This type of tank has been adopted as the standard army machine, although this is the first to be powered with a Diesel engine, burning low-cost fuel.

While the United States tank is capable of a top speed of 50 miles an hour, the highest speed credited to any Italian tank in Ethiopia is 25 miles an hour.

Other comparisons follow:

	American	Italian
Length	12 3/4 ft.	10 3/8 ft.
Height	6 1/2 ft.	4 1/2 ft.
Width	7 ft.	4 1/2 ft.
Weight, fully equipped	16,000 lbs.	5,940 lbs.

Engine—American, 260 hp. radial, air-cooled; Italian, 40 hp. water-cooled.

Crew—American, 4; Italian, 2.

Guns—American, 3 machine guns and sub-machine guns; Italian, 1 machine gun.

Turrets—American, 1 or 2; Italian, unknown.

Eighteen standard light tanks now are in service in the army. Officers said the light tanks have proved so efficient they have displaced all other types, including the heavy "juggernaut" machine.

No other Wrench would do as well—



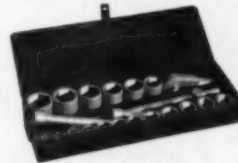
"Keep Going" with Snap-on

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There is a Snap-On handle for every job . . . plenty of power to break them loose and pull them tight . . . plenty of clearance to slip past obstructions. Snap-On straight wall (electric furnace alloy tool steel) sockets can "take" everything the man on the other end can GIVE. Balance, precision engineering and construction; fast, safe operation . . . try to find another wrench as good as Snap-On!

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We can build to your specifications a complete engine, test it in our engine tests shops and ship it direct to your customer.

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PRECISION PARTS AND ASSEMBLIES

STOVES AND DIESELS

Continued from page 19
has been in operation from 100 to 108 hours a week. During that period there has not been a single interruption of service. There is no connection to an outside supply to provide breakdown service should the engine fail. The entire operation of the plant is dependent on this one unit, but the engine has not caused a single minute's anxiety.

No full time engineer is required for the Diesel plant. After starting the engine in the morning, it is given a casual inspection every few hours. Caring for the engine is one of the several duties of the one who cares for the heating plant. During the 26 months that the engine has been in service the pistons have been removed but once. After removal for inspection and cleaning, the same rings were put back into service with satisfactory performance. Valves are cleaned every three to four months. A spare set of valves are carried and a complete change can be made in two and one-half hours. *Not a single bearing has been taken up during this 26 months of operation.*

A comparison of cost of power produced by the Diesel engine with that of purchased service shows a decided advantage for the former. During 1935, which can be considered a normal year in so far as plant operations are concerned, the cost of power was as follows:

Fuel Oil	\$1,771.61
Lubricating Oil	495.00
Labor	850.00
Repairs	87.00
Total	\$3,203.61

With a total production of 484,800 kw. hours, the cost per kw. hour was \$.0066, or a little more than 1/2¢ per kw. hour at the switch-board. The lowest cost at which current was ever purchased was \$.016 per kw. hour. Purchasing this same amount of power would have entailed an annual expense of \$7,756.80, which means a saving of \$4,553.19 for the Diesel.

If the item of depreciation of \$1,045.00 is added, the cost of Diesel power would be \$.0087 per hour, and the saving would be \$3,505.19, sufficient to pay for the plant within five to six years, surely a good investment.

Outstanding as is the saving shown by the Diesel engine, it is more remarkable that here is a power unit which is the sole source of supply, yet not once during more than two years of service has there been a moment's interruption. Surely this is evidence that the Diesel is dependable and economical, even when operating under heavy load for long periods of continuous service.

SHIRTS A LA DIESELS

Continued from page 42
lubricating oil for that amount of current was \$36.47 as compared to \$109.80 which would have been paid under the existing rate for purchased power or a saving of \$73.33 in one month. At the present time the load factor is only about 40 per cent since a sufficiently large unit was installed to accommodate business growth and expansion but even under these less favorable conditions the Diesel is providing power for one cent per kwh. or for one-third of the former rate.

Quite obviously, the remarkable power saving would be thorough justification for this conversion but that is not all of the benefit derived from the purchase of the Diesel. In addition to the above mentioned economies water jacket heat is recovered through the use of two Modine unit heaters suspended from the ceiling of the factory. It was found that a temperature of 78 degrees could be maintained with an outside temperature of 24 degrees without the use of the old steam boiler which had formerly been operated for heating.

A survey of costs in this respect showed an approximate reduction of \$50.00 per month which was entirely due to recovery of waste heat from the Diesel cylinder jacket cooling water. So much for winter and reduction of coal bills. In the summer months it is planned to circulate cold spring water through the Modine units and force cool air through the sewing room by means of the motor-driven fan behind each radiator.

The Diesel is started by means of a motor and storage battery. Ten 40-candle-power electric lights also operate from this battery and furnish night lighting when the engine is shut down. Continued satisfactory operation of this installation since December 1, 1935, has influenced the owners to discontinue power stand-by service with the local electric company which formerly served them. Summarizing briefly, the advantages of their new Diesel are as follows:

A 66% per cent reduction in power costs.

A \$50.00 per month reduction in winter heating.

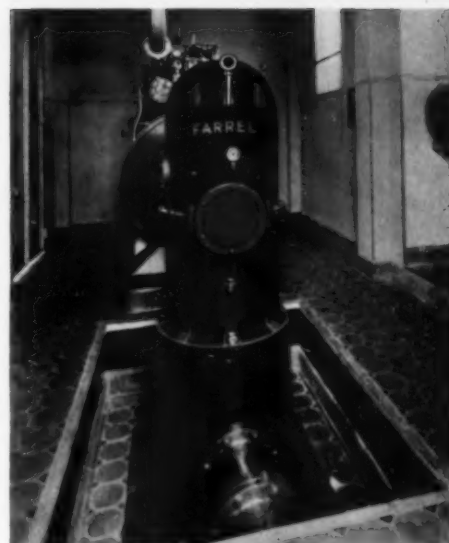
More comfortable working conditions.

THREE MONTHS' MOTOR SHIPBUILDING

SINCE the beginning of the year 57 motor ships of 370,000 tons gross have been ordered throughout the world. According to *The British Motor Ship*, the corresponding figure in 1935 was 250,000 tons.

ECONOMICAL DEEP WELL PUMPING

- Farrel Right Angle Drives are especially adapted for connecting Diesel or gas engines or other prime movers with deep well pumps, providing a compact, efficient and positive drive which will give continuous, trouble-free service.
- They have been developed with the cooperation of leading turbine pump and engine builders to meet the exacting requirements for the successful and economical operation of deep well turbine pumps.
- The quiet and efficient operation of many units already in service indicates correct design, carefully selected materials and first-class workmanship.
- They are built in a varied range of sizes up to 500 H.P. and up to 3600 R.P.M. pump speed. Send for copy of bulletin No. 525-A giving full details.



An installation of a No. 20 Farrel Right Angle Deep Well Pump Drive in Argentina. Unit steps up speed of 39 H.P., 514 R.P.M. Worthington Diesel Engine to pump speed of 1450 R.P.M.

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Morse Flexible Couplings absorb shocks and vibration and minimize bearing friction and wear.

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ENGINEERING SPECIALTIES CO., Inc.
39 CORTLANDT ST., NEW YORK CITY

● WANTED—Used Diesel Engines from trucks, tractors, and small boats. Address Box 106, c/o Diesel Progress, 2 West 45th St., New York, N. Y.

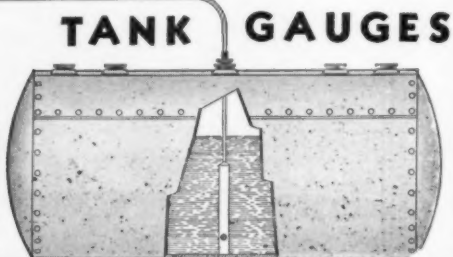
● WANTED—Diesel Engineer with factory experience. Preferably college graduate for demonstration and instruction work. Address Box 107, c/o Diesel Progress, 2 West 45th St., New York, N. Y.



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INSTALLATIONS

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RUMANIA'S KEEN ENGINEERS GET A SHOCK; DIESEL POWER CUTS COST OF BUILDING MILITARY AIRPORT \$64,500

RUMANIA'S military engineers are noted for their ability to correctly estimate construction costs, but in drawing up plans for the great Airport Baneasa near Bucharest, they missed the excavation figure by 6,875,000 lei, tied in erring, because they hadn't yet met

These efficient engineers, however, were justified in erring, because they hadn't yet met Diesel power. They had estimated an earth-moving cost of 33 cents per cubic yard, but the actual cost, including a complete write-off in depreciation of equipment and repairs, was only 7 cents per cubic yard for the 250,000 yards moved in the project.

The principal reason for this tremendous reduction in building costs was three 50-horsepower Diesel tractors. Modern equipment was used throughout the job, three large-capacity wagons, an elevating grader and blade grader and a gasoline-powered tractor. All tractors and graders were of "Caterpillar" make.

The Engineering Department of the Ministry of Aviation began close check on operating costs as soon as the project was under way, and continued their observations until it was completed. And here is what they reported:

1. The fuel cost per hour of each Diesel tractor was only 24.7 cents, as compared to 85.3 cents for the one gasoline tractor and small engine that operated the grader controls.
2. For all equipment, tractors, wagons and graders used on the job, the total operating cost per hour, including liberal allowances for depreciation, maintenance, fuel, lubricating oil and grease, was \$10.24
3. This fleet moved an average of 144.52 cubic yards of earth an hour, or a cost of 7.08 cents per yard. As previously stated, the engineers' estimate had been 33 cents.

Soldiers quickly learned to operate the equipment. Inasmuch as only military labor was

used on the project, salaries were not included. The engineers supplied figures to show what the job would actually cost a Rumanian private contractor, including his labor. The total per cubic yard would only be 11.9 cents.

Three Diesel tractors working on the fuel cost of one gasoline machine—that was the performance that aroused the tremendous interest of military authorities in Rumania. Minister of the Air Caramfil and former Minister Irimescu visited the project, and their enthusiastic reports on the speed and working economy of the modern excavating and leveling fleet drew King Carol himself for an official inspection of the works.

Diesel tractors are making enviable records in 58 countries, although the first machine was produced only four years ago. The King Albert Canal in Belgium, Zuider Zee reclamation work in Holland, the Iraq land irrigation program in the "Garden of Eden," airports in Tunisia, Corsica and France, together with the great Public Works dam jobs in the United States barely outline the world-wide scope of the growing age of Diesel power.

Even as King Carol came and saw the Diesels conquer, governments are taking cognizance of the material economies effected by these tractors, with the result that public programs impossible under old standards of construction costs, are being forwarded and swiftly, economically completed.

DIESEL RECORD TO EYSTON

CAPTAIN GEORGE EYSTON, ace British driver, established what was said to be the first official world speed record for Diesel-powered cars when he drove his Ricardo 12-cylinder Diesel over Bonneville Salt Beds, Utah, at a speed of 158.87 mph., April 30.

Eyston made three attacks on the measured mile. His first trial established a record of 155.36 mph.; his second attempt was better, 158.87 mph., and the third, an attempt to boost his speed by using larger wheels, netted a mark of 153.74 mph. Poor visibility was said to have caused the slower speed on the third trial.

Eyston drove the same straightaway course over which Sir Malcolm Campbell last September established a new world land speed record of 301.1292 mph.



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* LAMINUM BABBITTED SHIMS.
The soft babbitt tips seal the oil in the bearing! Quick, accurate service adjustments by simply p-e-e-l-i-n-g the laminated shim body.

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Whatever the size of engine that may be required or if there is a preference of type or design, the extensive line of Nordberg Diesels permits the selection of the proper engine for each individual need. They can be had in sizes from 150 horsepower upward.

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All work covered by same guarantee as borne by new instrument.

This service now used by some of the greatest industries in the country, for its speed, sound work and reasonable cost.

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SERVICE COMPANY, Inc.**
308 TWELFTH STREET
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PUBLIC SERVICE CORPORATION ORDERS DIESEL BUSES

PUBLIC SERVICE CORPORATION OF NEW JERSEY has purchased 27 Diesel electric buses from General Motors Truck Corporation. Electrical equipment will be furnished by the General Electric Company and the Diesel engines by the Hercules Motors Corporation. Delivery is expected in about four months.

The decision to purchase the Diesel Electric equipment follows a series of tests, covering nearly six years, of a Diesel engine installed in place of a gasoline motor in one of the company's buses. An all service vehicle equipped with a Diesel has been in operation on two of the system's lines for several weeks.

This particular development is extremely interesting to the Diesel industry because it is the first group application of Diesel electric drive to transport vehicles. Of course, it is well known that the Public Service Coordinated Transport, which is the bus operating subsidiary of the Public Service Corporation, has been operating gasoline electric buses for a long time which undoubtedly explains their decision to use Diesel electric drive instead of straight drive.

Later on this Fall DIESEL PROGRESS will publish illustrations and details of these buses.

McGILL STARTS AGENCY

R. F. MCGILL, one of the best known men in the whole Diesel industry, recently formed the Diesel Plant Specialties Co. in Chicago to represent various Diesel accessories and has already lined up such well known units as: Maxim Silencers, "Maihak" Indicators, Vortex Air Cleaners, Sentinel Oil Filters, etc.

Mr. McGill has a background of over twenty years of experience in this Diesel industry, working through the experimental department, test rooms and field service, and then finally their sales, his last connection being manager of Diesel Department of the Chicago Office of Fairbanks, Morse & Company.

So he offers to the Diesel user and prospective Diesel user a real knowledge of his requirements and is in a position to render a real service in working out for the Diesel user the best installation for his particular job in so far as accessories are concerned.

**LEARN
DIESELS
TODAY —**

**KNOW
SUCCESS
TOMORROW**

● Diesel power is beyond the experimental stage in industrial power and lighting plants; small community power and light plants; municipal pumping stations for water supply; on construction work, trucks, tractors, hoists, power shovels, graders; transportation, with special reference to buses, rail buses, locomotives; marine service, including ocean liners, freighters, river and lake vessels, yachts and small cabin cruisers.

● Diesel power is a fact—and destined to become a greater power fact in the future. Recognition of this fact is the first step toward capitalizing on this national trend. Doing something about it—for yourself—is the next step. Thousands of men have done something for themselves by spare-time study of the I.C.S. Diesel Engine Course. Why not you? This coupon is the doorway to your own success in the Diesel field. Mail it today!

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Box 105, c/o DIESEL PROGRESS
2 WEST 45th STREET, NEW YORK, N. Y.

AIR MAIL SERVICE

Continued from page 31

tandem in the engine nacelle which forms the center section of the wing. They are the latest product of the Junkers factory—the *Jumo 205-C*, which is rated at 550 hp. at 2,100 rpm. at 8,200 ft. The front engine projects ahead of the wing, and the rear engine is located between the two wing spars with an extended propeller shaft, which gives the nacelle an excellent streamline shape. Three-bladed metal propellers 11 ft. 6 ins. in diameter are used on both engines.

The radiators for each engine are placed one above the other in front of the turret, and as they are rounded, they offer little air resistance. The water tanks in the top of the nacelle can be replenished from the larger tank in the hull by a hand-operated semi-rotary pump.

The *Do 18* has a span of 77.7 ft., an overall length of 63 ft. and a wing area of 1,055 ft. Empty, it weighs 11,814 lbs., and when fully loaded, its gross weight is 20,240 lbs. The Diesel fuel carried weighs 6,000 lbs.

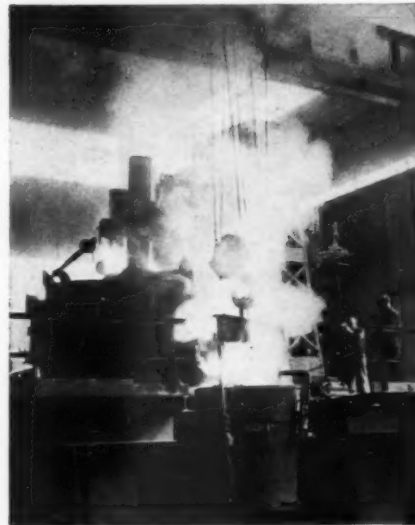
The flight range, based on a cruising speed of 130 mph., is 2,670 miles, which makes the fuel consumption 2.29 lbs. per mile. At a cruising speed of 112 mph., the flight range is increased to 2,900 miles, with a fuel consumption of 2.05 lbs. per mile. The maximum speed is 155 mph., the landing speed is 56 mph. and the ceiling is 14,450 ft.

FIRST DIESEL-ELECTRIC PASSENGER LINER

THE Hamburg Amerika Line has just ordered a passenger liner which, according to *The British Motor Ship*, will be the first vessel of this class propelled electrically, in conjunction with Diesel engines. As is well known, the *Normandie* is an electric ship, but she is equipped with steam turbo-generators, supplying current to the propelling motors. In the case of the Hamburg Amerika Line vessel, however, Diesel engines will be utilized instead of steam turbines. As the owners will, no doubt, have to consider the construction of a large trans-Atlantic liner at a later date, it is possible that they wish to gain experience with this novel form of machinery with a view to its adoption in much larger ships.

National Forge and Ordnance Company

Irvine, Warren County, Penna.



All National Forge and Ordnance Company products are manufactured from fine quality Basic Electric Steel.

Complete control of all processing from selection of the melting charge to the finished condition is National Forge and Ordnance Company's guarantee for maintenance of quality in crankshafts and various other types of forgings furnished to leading manufacturers in the Diesel industry.

BASIC ELECTRIC STEEL FORGINGS



Carbon, Alloy, Corrosion Resistant and Special Steels Smooth Forged, Hollow Bored, Rough or Finish Machined, Heat Treated to Specifications. . . Forging Quality Ingots, Pressed or Hammered Billets.

Spark Arresting Mufflers
—FOR DIESEL EXHAUSTS—
THE MAXIM SILENCER CO.
—HARTFORD, CONNECTICUT—

• **WANTED:** Up-to-date used Diesel Installation having an output of 1,200 kilowatts. Give complete details as to manufacturer of engine and generator; price and location. Box 104, c/o Diesel Progress, 2 W. 45th St., New York, N.Y.

GOULDS HYDROIL CENTRIFUGAL PURIFIERS
For fuel and lubricating oils
GOULDS PUMPS, Inc.
Seneca Falls, N. Y.

GEORGE D. POGUE

THE passing of George D. Pogue on May 3rd, 1936, takes from engineering and, particularly, the Diesel engine field one of America's most successful engineers and salesmen.

George D. Pogue was born in St. Louis, June 20th, 1878. After having gone through the public schools of St. Louis he went with the General Electric Company at Schenectady and served an apprenticeship with that company. From Schenectady, he returned to St. Louis and was engaged with the Western Electric Company in the field of heavy electrical equipment. During this time he contributed a number of very valuable inventions to the electrical field. He later engaged with the Harrisburg Foundry and Machine Company in the sale of steam engines and equipment and immediately became one of the most successful sales engineers in the steam power field. About 1906, Mr. Pogue was attracted to the Diesel engine and took up the active promotion of sales and installations of Diesel engines for the old American Diesel Engine Company which was succeeded by the Busch Sulzer Diesel Engine Company; afterwards going with the Fulton Iron Works Company of St. Louis as the manager of their Diesel Oil Engine Department. His activities were again most successful and during this period he not only promoted and sold numbers of conspicuous Diesel engine installations but contributed to this field numbers of valuable inventions and improvements to Diesel engines.

During the War, Mr. Pogue left the Diesel field and engaged in engineering work of the most constructive and important detail and, latterly, re-entered the Diesel engine field with the Busch Sulzer Diesel Engine Company, again meeting with singular success in both the stationary and large marine field.

Mr. Pogue was latterly with the Winton Engine Corporation. During his career he applied and was granted more than one hundred and twenty-five patents on mechanical and electrical devices; all of them being ingenious and of great merit.

He was a tireless worker, a genius in engineering, a highly successful sales engineer, a man who served well his principals, of kindly and generous thoughts who loved his friends and merited the affectionate regard of everyone who knew him.

In the passing of George D. Pogue, the Diesel

DIESEL PROGRESS

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engine industry has lost one of its pioneers, a tireless worker and a successful champion of the industry.

His friends numbered scores over the entire nation, all of whom will feel a keen sense of personal loss upon learning of his passing.

"BREATH OF HELL"

Continued from page 23

and evaporates as it melts, leaving no drip of water to drain.

With some fourteen wells sunk in the Devil's Kitchen, the Pacific Imperial Dry Ice Company expanded its business year by year throughout the depression and in spite of it. The gas is piped to compressors which operate on electric power furnished by a 300 hp. Cooper-Bessemer Diesel. A second Diesel installed as an auxiliary to handle smaller jobs in the plant is a 10 hp. Bromfield Deutz. It is rather ironical to note that the Cooper-Bessemer Diesel first saw service in a yacht before being brought out to the desert to work in the hottest spot in the United States to make the coldest product man uses. Regardless of the terrific desert temperature and the altitude which is (-) 200 feet, both Diesels are delivering dependable, inexpensive power and are reported completely satisfactory in every respect.

The market for this dry ice is the city of Los Angeles 150 miles distant. The cakes are wrapped in paper and delivered by truck to sell for three cents a pound.

Some of the physical properties of dry ice are as follows:

Temperature at atmospheric pressure (-) 109 degrees fahrenheit.

Density 95 pounds per cubic foot.

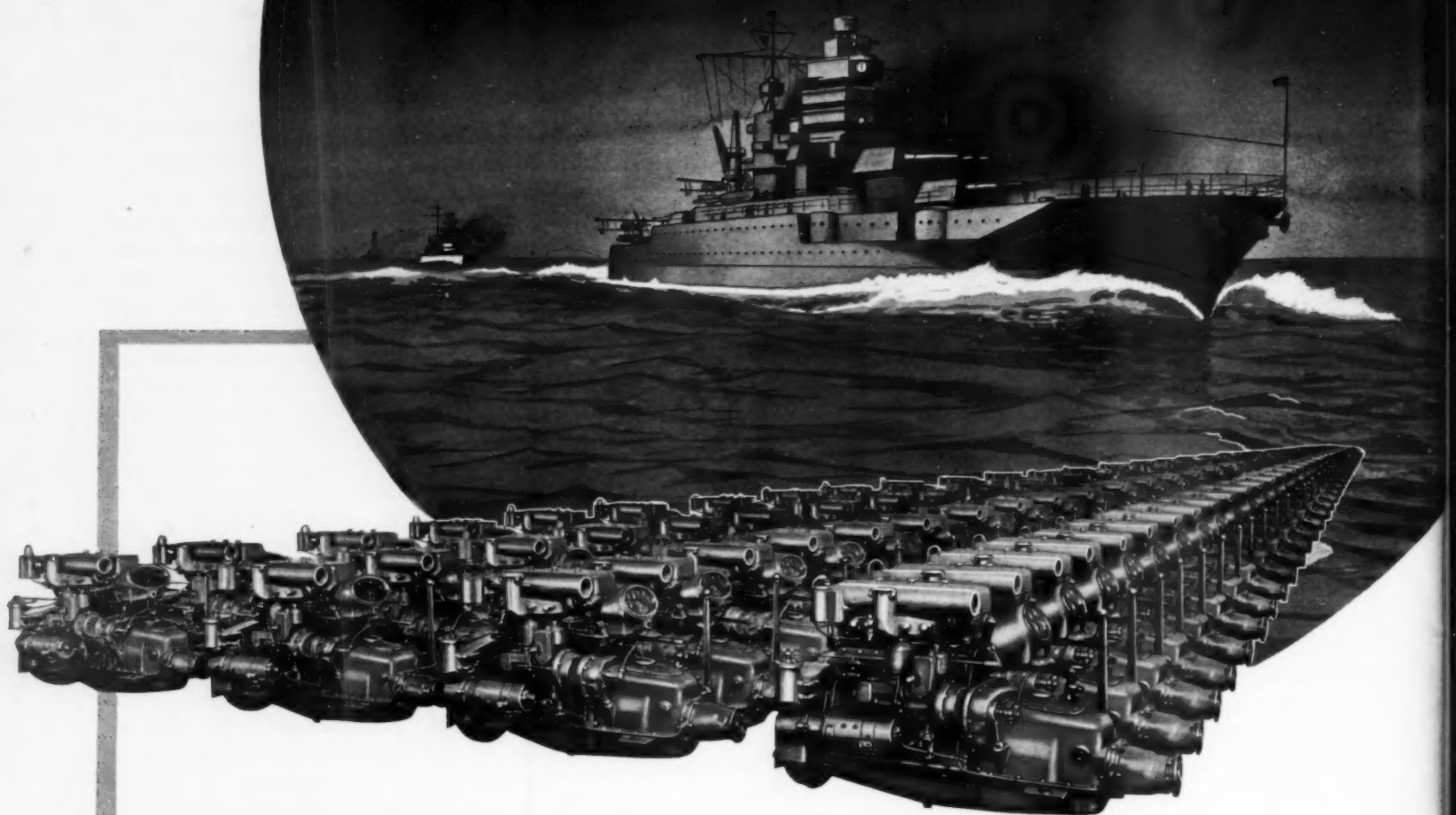
Weight of commercial 10" cube 55 pounds.

Refrigeration per pound at 50 degrees F. 277 btu.

In the compressor plant the gas is compressed to 600 pounds per square inch pressure. It is liquified in a hydraulic press and then becomes snow which is pressed into blocks in a twenty-ton press. Five hundred cubic feet of gas are required to produce one fifty-pound cake of dry ice. All this takes place in a summer temperature of 130 degrees in the shade and, to quote the engineer, "there is no shade!"

Thus DIESEL PROGRESS submits again through proof of performance that for Diesels no job is too tough, no power requirements too exacting and no service too rigorous.

THEY *Must* BE GOOD TO BE CHOSEN BY THE U.S. NAVY



THESE BUDA DIESEL MARINE ENGINES ARE BU-NITE PISTON EQUIPPED...

The efficiency of the U. S. Navy depends upon the smallest as well as upon the largest units in its service. That these Buda Diesel Marine Engines were selected by the Navy, after a long period of investigation, for tenders and motor launches, is a tribute to Buda Engineering and dependability. The severe and exhaustive tests to which the engines were subjected are all the more reasons why we should take pride in the fact that each engine is Bu-Nite piston equipped.

In the largest as well as the smallest sizes, Bu-Nite Nickel-Alloy Pistons are daily proving their superiority over all other types for Diesel service.

DELCO-REMY CORPORATION

ANDERSON, INDIANA, U. S. A.

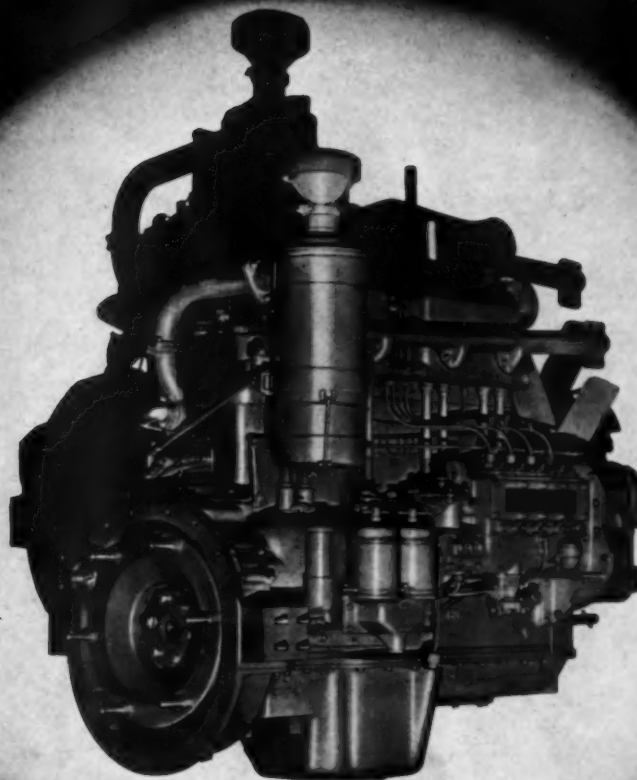


A Bu-Nite Piston designed for heavy duty service. The type used in the BUDA MARINE DIESEL Engines.



FIRST

— IN P R E F E R E N C E
— IN P E R F O R M A N C E



A constantly increasing demand for "Caterpillar" Diesels proves the overwhelming preference for this pace-setting, record-breaking power. In cranes, crushers, compressors, other portable equipment—in scores of stationary plants—in road machinery and tractors—it's the "Caterpillar" Diesel that has set the standards for stamina and dependability, for sure control and versatility, for low maintenance and operating costs. Around the world, it's first in preference because it's first in performance—the power SHOW-DOWN! Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

HARD FACTS ON THE SHOW-DOWN:

"My 'Caterpillar' Diesel," reports a California owner, "pumps 700 gallons of water a minute from a deep well. The fuel cost is 3/10 of a cent per 1000 gallons—12 cents for 42,000 gallons an hour. And I used to pay 97 cents an hour for electric power!"

In North Carolina, a "Caterpillar" Diesel Power Unit operated two crushers, two conveyors, and a rotary screen—crushing 250 yards of rock (to 1¼") every 10 hours on 35 gallons of low-price fuel per day.

CATERPILLAR DIESEL

REG. U. S. PAT. OFF.



HERE IS ONE DOCTOR WHO TAKES HIS OWN MEDICINE

THERE has been a lot said about overproduction in the oil industry. Strangely enough some of the oil companies have taken little interest in increasing the consumption of their own products.

Here is one of them, the Atlantic Pipe Line Company, which believes it is economically sound to develop its own power from its own products.

Atlantic Pipe Line pumps are motor driven but the power is generated by Cooper-Bessemer 340 H. P. Type-JT Diesel engines. Seven of these units were put into operation in May, 1933. The Mt. Enterprise Texas Station containing three of these Diesels is illustrated. The engines operate on East Texas crude oil.

Cooper-Bessemer Diesels range in size from 50 to 1250 H. P. They are built for stationary, railway and marine service.



THE COOPER-BESSEMER CORPORATION

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